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Project W-3-R-12
CARIBOU MANAGEMENT STUDIES

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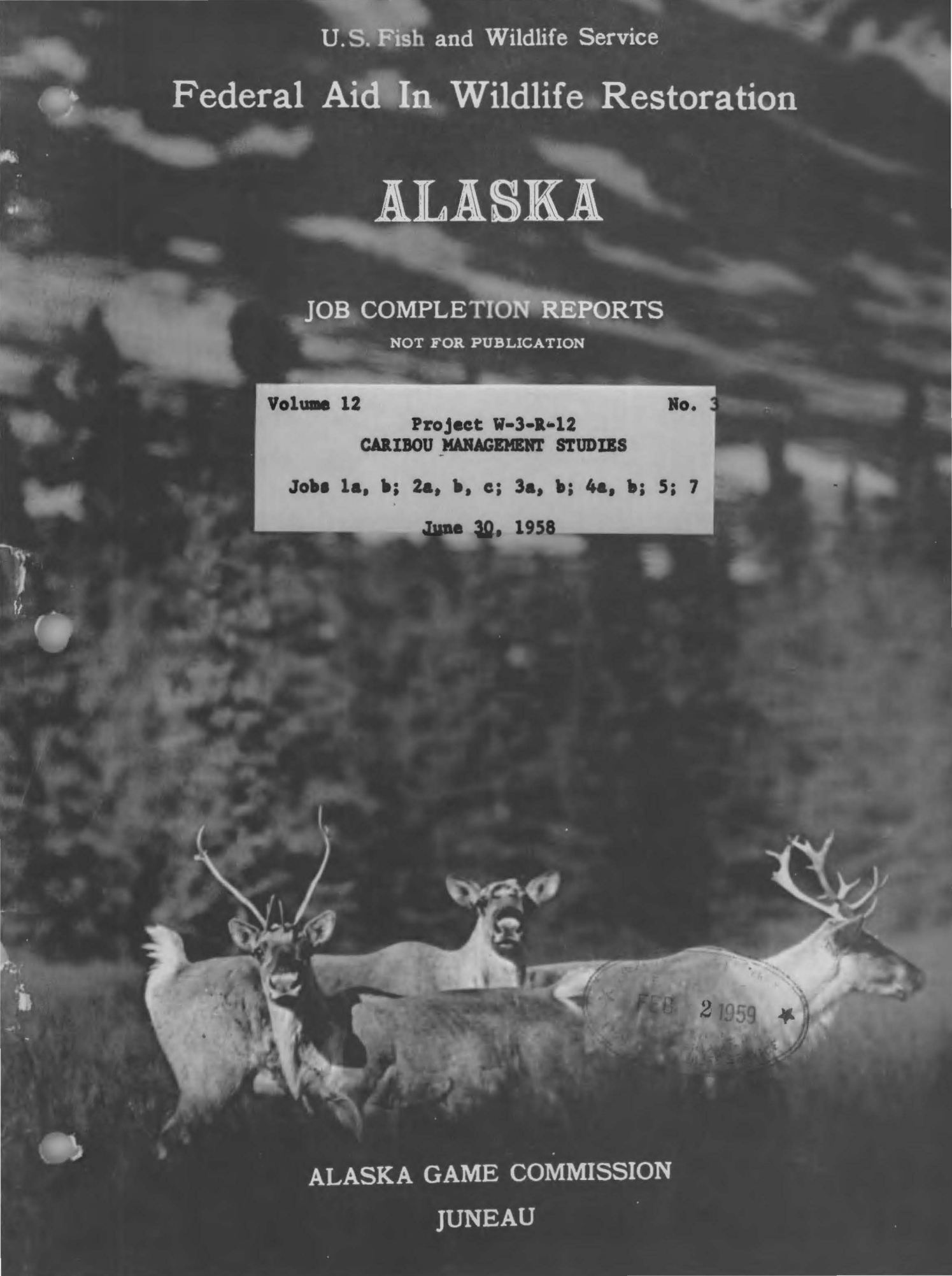

ALASKA GAME COMMISSION

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Volume 12 Number 3

JOB COMPLETION REPORTS

Project W-3-R-12 Alaska June 31, 1958

Wildlife Investigations

Work Plan B

CARIBOU MANAGEMENT STUDIES

Personnel

Robert F. Scott, Supervisor Game Restoration
Sigurd T. Olson, Wildlife Management Biologist
Ronald O. Skoog, " " "
David R. Klein, " " "
Herbert C. Hanson, Range Ecologist
Alan Courtright, Biological Aid
Sam Harbo, " "
Howard Kantner, " "
James Whisenhant, " "
Willy Miller, " "

Urban C. Nelson
Chief, Fish and Game Restoration

Clarence J. Rhode
Executive Officer
Alaska Game Commission

Not for Publication

(The results described in these reports are preliminary and often fragmentary in nature. Conclusions are subject to change with further investigation and interpretation.)

C O N T E N T S

SUMMARY

Job No. 1(a): Sampling of Kill by Hunters--Nelchina Herd

The 1957 hunting season proved successful for about one-third of the people that hunted the Nelchina caribou. Most of the herd remained inaccessible throughout the season, resulting in an estimated kill of only 2,500 animals, of which about half were taken during the first three weeks. The data can be summarized as follows:

1. The total kill was estimated at 2,500 caribou.
2. 75 percent of the animals killed were males.
3. 70 percent of the animals killed were 2 to 6 years old.
4. 36 percent of the hunters were successful.
5. 65 percent of the successful hunters took one caribou; 27 percent took two; and 8 percent, three.

Job No. 1(b): Sampling of Kill by Hunters--Steese-Fortymile Herd

The 1957 hunting season resulted in a much reduced kill compared to previous years, however, individual hunter success was good, since approximately 55 percent of the hunters killed at least one caribou. Ninety-two percent of the kill was sustained on the Taylor Highway. The kill data are summarized below:

1. Total kill was 648 caribou.
2. Fifty-nine percent of the kill were males and 41 percent females.
3. Fairbanks hunters provided 68 percent of the hunting pressure.
4. Ninety-seven percent of the total kill were adults.
5. Hunting pressure during the highway crossing was down 50 percent from 1956.
6. Limit of three increased the kill approximately 13 percent during the period October 1-14 when the greatest hunting pressure occurred.

7. Non-resident hunters comprised 11 percent of the hunters in September and four percent in October.

8. Military hunters comprised only 11 percent of the total hunters.

9. Lack of hunting pressure was the main reason for reduced kill.

Job No. 2(a): Movements, Distribution, and Numbers--Nelchina Herd

Movements by the Nelchina caribou during the past year continued to reflect the western shift in range use evident in recent years. The previously favored wintering grounds on the Lake Louise-Ewan Lake flats have become almost deserted, and only a few thousand caribou wintered there during 1957-58. The bulk of the herd utilized the Deadman-Nadiwen Lakes region for much of the year, although the foothills of the Talkeetna Mountains remained important during spring and early summer. For the first time in recorded history, a major portion of the herd wintered along the Talkeetna River with bands extending as far west as Rainbow Lake. The Monahan Flat also was utilized by moderate numbers of caribou. This westward shift is considered beneficial as concerns range use, but its cause is unknown.

A census was not feasible due to the herd's distribution, but an estimate of total size was made by utilizing productivity and mortality data. At present, the herd probably contains at least 45,000 animals.

Job No. 2(b): Movements, Distribution, and Numbers--Steese-Fortymile Herd

The calving segment of the herd moved northwestward to the Charley River and White Mountain areas in May. Immediately after calving, a general wide dispersal over the summer ranges occurred between the Steese and Taylor Highways. No large concentrations or significant movements were observed during the summer months. By late September, most of the caribou had begun to move southeast and by October 20 most of the herd had crossed the Taylor Highway and moved into Canada toward the Ogilivie Mountains east of the Yukon, and into the lower Sixtymile River. A small group of caribou, numbering approximately 2,000 wintered between Beaver Creek and the Yukon flats near Circle. A similar sized herd ranged between the Sixtymile River, the Ladue, and White Rivers. The whereabouts of the main herd was not discovered during the winter.

Job No. 2(c): Movements, Distribution, and Numbers--Arctic Caribou

There were relatively few caribou in northwest Alaska until the summer months. By late fall and winter, caribou were spread widely but thinly throughout the Kobuk-Noatak area as well as along the coastal areas.

In the Central Brooks Range and on the Arctic slopes, caribou remained generally north of the range in large numbers until September. By November, several small migrations distributed caribou between Hughes, Kobuk, and Wiseman, however, most of the caribou remained either in the Brooks Range or on the Arctic slopes.

During October, part of the Porcupine herd moved south along the Richardson Mountains east of Old Crow swinging westward across the head of the Black River to the Porcupine River near Settlement. Part of the herd crossed the river and began the winter in the Coleen-Sheenjek area while the larger remaining portion spread out along the Porcupine and segments gradually drifted southeast again toward Canadian wintering grounds.

Both the Delta River and Minchumina herds showed an increase in numbers during 1957. These herds frequented their respective ranges and showed no change in seasonal movements from other years.

Job No. 3(a): Analysis of Productivity--Nelchina Herd

The main period of the rut occurred during the first two weeks of October. The mating season progressed successfully judging from the fertility and parturition rates observed later.

Fertility data revealed that about 70 percent of the cows one-year and older were pregnant, and about 82 percent of those two-years and older. Two of nine yearlings checked were pregnant.

Calving progressed similarly to past years, and the peak again fell about May 25. About 80 percent of the cows on the calving grounds dropped calves. It was estimated that about 60 percent of all cows older than yearlings had calves at the end of June. The final calf crop was estimated at 12,500.

Calf survival during the 1957-58 season was good with about 68 percent of the calves surviving to the yearling stage. About 25 percent of the calves died during the July-November period, but about 90 percent of those living November 1 survived to mid-April. The high survival is attributed to the extremely mild winter and lack of snow.

The increment of yearlings to the herd was estimated at 8,500. The Nelchina herd continues to increase under the effects of high calf crops and calf survival and of low hunters' take.

Job No. 3(b): Analysis of Productivity--Steese-Fortymile Herd

Productivity and survival studies during 1957 and 1958 provided the following information:

1. Calving occurred in two widely separated areas. The largest calving concentration was located on the Charley River. The second calving area was located in the White Mountains north of the Steese Highway.

2. Calving activities began about May 24 or 25, rose to a peak on May 28 or 29, and were practically over by June 6.

3. Limited data indicate the initial calf:cow ratio was 70:100.

4. The calf:cow ratio obtained during the highway crossing (June 7-18) was 38:100, indicating an early mortality of 46 percent.

5. A count of cows with distended udders without calves yielded an early calf mortality index of 24 percent. The actual figure probably lies somewhere between 24 and 46 percent.

6. The yearling:cow ratio was only 3:100 indicating a low calf survival rate for the preceeding year. Calf:adult ratios obtained during the preceeding winter substantiate the low yearling:cow ratio above.

7. Calf:adult ratios obtained during the winter of 1957 and 1958 are similar to those obtained the previous year. If these are characteristic for the entire herd, a decrease in total numbers is inevitable in the near future.

8. At Eagle Summit, 7,300 caribou (including calves) were counted crossing the Steese Highway.

9. Composition counts on 4,328 individuals crossing June 7-13 indicate that 26 percent were calves, 3 percent yearlings, 70 percent cows, and one percent bulls.

Job No. 4(a): Herd Composition Surveys--Nelchina Herd

Composition counts taken throughout the year provided information on calf survival and on composition changes occurring with major movements. The effect of hunting was discussed, and kill data from previous years were presented. The herd was estimated on May 1, 1958 to consist of 19 percent yearlings, 46 percent cows, and 35 percent bulls.

Job No. 4(b): Herd Composition Surveys--Steese-Fortymile Herd

Herd composition data collected during 1957-58 provided information on the present status of the Steese-Fortymile caribou herd.

1. The sex ratio of the kill was 144♂:100♀. The unbalanced sex ratio is thought to be the result of hunter preference for males.

2. Calf counts indicate that only 3 1/2 percent of the total herd were calves indicating very low calf survival for the second year.

3. Age composition for the adult segment of the herd (based on analysis of jaws from hunter kills) shows a continued trend toward larger, older age classes (4-6 years) and smaller, younger age classes (2-3 years). This indicates either herd stabilization or decrease in number and general thriftiness of the herd.

Job No. 5: Caribou Stomach Analysis

Twelve stomach samples were analyzed. A sample from the reticulum of one stomach was analyzed for comparison with the rumen sample of the same stomach.

It is becoming evident that data based on analysis of the large plant particles in the samples are inaccurate and misleading, particularly for lichens which tend to be present in larger proportions than the data indicates.

A method devised to measure the amount of material passing through the separating screens indicated that much of the stomach content is comprised of protozoa (not yet identified).

Job No. 7: Winter Range Utilization--Nelchina Herd

Two field trips during the winter of 1957-58 provided limited data on the utilization of the range by caribou during that season. Feeding areas were examined along the upper Talkeetna River and in the Fog Lakes region. Eleven caribou were collected for stomach samples.

The main food plants eaten by the caribou in these two areas proved to be lichens and sedges. Some animals also had fed upon the buds and twigs of willow.

The data gathered showed that in a feeding area of moderate use there was one pawed-out plot for approximately every 40 square meters of ground; the total amount actually disturbed by the feeding reached only 0.7 percent of the whole. In a feeding area of heavy use there was one pawed-out plot for approximately every 11 square meters of ground; the total amount disturbed was only 2.2 percent.

About 95 percent of the plots examined completely contained broken or uprooted portions of plants--the lichens being the most damaged. Trailing affects the vegetation adversely, also, but its effect is difficult to evaluate.

The significance of the data gathered will not be known until a more thorough coverage of the range is made and until the range study as a whole is completed.

JOB NO. 1(a)--Sampling of Kill by Hunters--Nelchina Herd

PERIOD COVERED: August 20, 1957, to December 31, 1957

ABSTRACT

The 1957 hunting season proved successful for about one-third of the people that hunted the Nelchina caribou. Most of the herd remained inaccessible throughout the season, resulting in an estimated kill of only 2,500 animals, of which about half were taken during the first three weeks. The data can be summarized as follows:

1) The total kill was estimated at 2,500 caribou.
2) 75 percent of the animals killed were males.
3) 70 percent of the animals killed were 2 to 6 years old.
4) 36 percent of the hunters were successful.
5) 65 percent of the successful hunters took one caribou; 27 percent took two; and 8 percent, three.

OBJECTIVES

To determine the magnitude and characteristics of the caribou kill, including the gathering of sex and age data, biological specimens, and general hunting season statistics.

TECHNIQUES USED

Several methods were employed during the hunting season to gain estimates of the magnitude and characteristics of the kill. Two hunter checking stations run during the first of the season provided much of the information--one on the Glenn Highway at Palmer, August 20 to September 4, and September 7, 8, 14, and 15; and the other on the Denali Highway near Paxson, August 20 to September 4. At each station the following data were recorded for each hunting party: area hunted, total hunters, days hunted, kill, and information on the bag-limit, the last designed to determine the effect of the increased caribou limit of three. These data also were recorded by all FWS personnel in their field checks of hunters. Most of these checks were made by Game Management Agents throughout the season. Interviews with guides and outfitters operating in the Nelchina caribou range provided figures on their take. Lower-jaws were collected whenever possible, and the sample obtained was used to determine the age structure of the kill. The collection of other biological data included examining carcasses for disease, injuries, and parasites; weighing and measuring animals; taking stomach samples; and collecting

ovaries for reproductive data. Various estimates by the writer --based on talks with residents, roadhouse operators, guides and outfitters, and his own knowledge--served to fill-in the obvious gaps in the available data.

All of the raw data are filed in the Anchorage office of the Federal Aid to Wildlife Restoration Branch.

FINDINGS

Inaccessibility of the major portions of the Nelchina caribou herd during the hunting season resulted in the lowest kill since 1954. Only scattered bands of caribou were available to foot and boat hunters, a group comprising about 70 percent of all hunters. Those using tractors to hunt could reach caribou mostly during the first month, but not at all during the last two months. Airplane hunters, a definite minority, were the only ones able to get good hunting throughout the period. Apparently an extended season--August 20 to December 31--and an increased limit--three, either sex--cannot in themselves insure an adequate kill, although both facilitate a larger one than otherwise possible. Caribou distribution and movements seem to be the main factors in determining hunting success.

At the start of the season the bulk of the herd still remained in the Deadman-Nadiwen Lake region, where it had been for much of the summer. Hunters were able to take caribou along that portion of the Denali Highway lying just north of Nadiwen Lake during the first three weeks of the season, but the animals became quite scarce by mid-September. Snows closed the road in November before any significant numbers again reached the highway. Also during the early part of the season, many caribou were available to tractor hunters in the area lying between the heads of the Oshetna River and Tyone Creek, and scattered groups extending to the Glenn Highway near Eureka were accessible to foot hunters. Most of these animals had moved northward by mid-September, however, and they remained out of reach the rest of the season, except for one segment that swung south again in mid-October almost to Eureka, affording some hunting before moving off to the northwest. Stragglers, of course, occurred at many portions of the range, and some provided limited hunting. Airplane hunters could reach caribou at lakes, river bars, and ridges in many parts of the range.

Throughout the season, then, the main portions of the herd, which consist mostly of cows, calves, and young animals of both sexes, remained out of reach of most hunters. Those animals most exposed

to hunters were those ranging along the periphery of the concentration area, and these normally contain a high proportion of adult bulls. The kill data presented later tend to reflect this distribution.

Magnitude of the Kill.

The 1957 caribou kill by hunters was estimated at a maximum of 2,500 animals--the lowest kill since 1954, when the estimate was 2,000. Caribou distribution as explained above probably was the main factor. Table 1 lists the data on total kill, as obtained from hunter checking stations, field checks of hunters, and interviews with guides and outfitters.

Table 1. Estimated caribou kill during 1957 hunting season.

Source	Dates Covered	Number of Caribou Killed		
		Actual Tally	Estimated Additional	Total Estimate
Checking Stations:				
Paxson	8/20-9/4	506	19	525
Palmer	8/20-9/4; 9/7, 8, 14, 15	495	30	525
Field Checks	8/20-11/30	125	25	150
Guides & Outfitters	8/20-11/30	511	389	900
Other	8/20-12/31	0	400*	400*
Total		1,637	863*	2,500*

*Maximum

By actual tally 1,637 caribou were recorded as being taken. This figure contains some duplications, however, because the kills of some hunters using commercial facilities appear both in the data from checking stations and in that from guides and outfitters. Kills of some of the hunters checked in the field possibly appear in the checking station data, also. These duplications cannot be separated, but there probably are not too many, because of the short period in which the stations were operated. The records of the two stations themselves, however, are distinct.

The estimates appearing in the "Total Estimate" column of Table 1 were made by the author, based on talks with residents, guides, outfitters, and FWS personnel, plus his own knowledge of caribou availability and numbers of hunters. The figures expressed in the "Estimated Additional" column are simply the differences between the actual tallies and the total estimates.

Composition of the Kill.

Sex and age data were obtained from caribou carcasses whenever possible, and the samples thus obtained were used to determine the composition of the kill. Table 2 summarizes the data on sex composition and Table 3, that on age.

Table 2. Sex composition of 1957 caribou kill, as obtained from examination of hunters' kills.

	Source of Data							
	Denali Checking Station		Palmer Checking Station		Field Checks		Total	
Sex	No.	%	No.	%	No.	%	No.	%
Male	374	74	358	72	112	91	844	75
Female	132	26	137	28	12	9	281	25
Total	506	100	495	100	124	100	1125	100

Table 3. Age composition of 1957 caribou kill, as obtained from examination of hunters' kills.

	Male		Female		Unknown		Total	
Age	No.	%	No.	%	No.	%	No.	%
Calf	4	2	4	6	3	17	11	4
Yearling	13	8	7	10	6	33	26	10
2 Years	36	21	11	16	1	6	48	19
3 Years	40	24	14	20	3	17	57	22
4-6 Years	48	28	22	32	4	21	74	29
7-9 Years	25	15	9	13	1	6	35	14
10 + Years	3	2	2	3	0	0	5	2
Total	169	100	69	100	18	100	256	100

Bulls constituted 75 percent of the 1,125 animals sexed. This high ratio indicates a definite selectivity toward the taking of males, because actually they comprise only about 45 percent of the total herd. The distribution of caribou during the season, as described above, exerted great influence, because a greater proportion of bulls were available. Hunters themselves, however, seem to be more inclined

to shoot bulls than cows, probably because they wish a better set of antlers or perhaps simply because they tend to pick the largest animal from any group of caribou they see. Regardless, the high proportion of bulls in the kill remained consistent with past years' records.

The age structure of the kill, as shown in Table 3, resulted from 256 lower-jaws aged by the writer. The aging technique used is based on tooth eruption and relative wear, and has been described in previous reports; the yearly age-designations after three years are not necessarily true. The data show that 55 percent of the animals were less than four years old, 41 percent being classed as two- and three-year-olds. Only 16 percent were classed as being over six years old, and only 14 percent, as calves and yearlings. Thus 70 percent of the kill consisted of animals between two and six years of age. The lack of old animals indicates that the population is a young one; the lack of calves and yearlings, however, reflects mostly caribou distribution, those age-classes being most represented in the main concentration areas, and possibly hunter selectivity. With the exception of the low calf and yearling percentages, the age structure as a whole resembles that obtained in previous years.

Characteristics of the Kill.

In general, the hunting interest seemed rather subdued again this year, probably because the long season allows a wider dispersion of the hunters. Many now wait to hunt caribou later in the season, and spend the first portion on moose and sheep. The lack of caribou, however, caused many people to hunt throughout the season, and roadhouse operators reported a fair weekend business well into December. Nevertheless, about half of the kill took place during the first three weeks of the season. Table 4 summarizes the data concerning caribou hunting as obtained from checks of hunters.

During the season 935 hunting parties were checked, including a total of 2,196 hunters. The average of 2.3 hunters per party follows closely the averages obtained during previous years, as does the average of 2.9 days of hunting per hunter. Successful hunters comprised only about one-third of the total hunters this year, compared with last year's success figure of about 50 percent. The lower hunters' success can be attributed directly to the inaccessibility of the caribou.

Data concerning the bag limit show that about two-thirds of the successful hunters took one caribou; about one-fourth, two; and less than one-tenth, the limit of three. Thus, hunters taking a second

Table 4. Summary of data concerning caribou hunting, as obtained from hunter checking stations and field checks of hunters during 1957 hunting season.

Item	Denali Checking Station		Palmer Checking Station		Field Checks		Total	
	No.	%	No.	%	No.	%	No.	%
Hunting Parties	492		374		69		935	
Caribou Hunters	1,229		786		181		2,196	
Hunters/Party	2.5		2.1		2.6		2.3	
Total Man Days	2,817		2,546		968		6,331	
Days/Hunter	2.3		3.2		5.3		2.9	
Caribou Taken	506		495		125		1,126	
Successful Hunters	347	28	344	44	102	56	793	36
Hunters w/1	215	62	222	65	81	80	518	65
Hunters w/2	105	30	93	27	19	19	217	27
Hunters w/3	27	8	29	8	2	1	58	8

caribou increased the kill by 35 percent, while those taking a third increased the kill only 5 percent. One can probably assume from these statistics that a further increase in the bag limit would not increase the total kill greatly.

A further analysis regarding the bag limit appears in Table 5. Of the successful and potentially successful hunters, 325 were interviewed who had the opportunity to take more caribou than they had taken. Of this number, 17 percent refused to take any caribou (presumably they were trophy hunting), 50 percent refused to take more than one, 25 percent refused more than two, while 8 percent actually took the limit. Thus, 92 percent of the hunters having the opportunity to take caribou refused to fill the bag limit. Yet, a survey of 777 hunters revealed that 29 percent said they wanted three caribou. Apparently a change of "heart" occurs once the hunters enter the field and are faced with the decision of actually shooting their limit. All data point to the fact that most people do not want three caribou, and probably very few would ever want more than three.

Discussion.

The 1957 kill in the Nelchina caribou herd did not reach a desired magnitude, and represented probably less than half the annual increase. This herd is fast growing out of reach in regard to the control of its numbers, for hunters now can just barely crop the annual increase when the caribou are readily available. Continued high calf crops and mild winters during the past three years have all contributed to the herd's increase. Although the long season and large bag limit certainly help to increase the kill, they cannot insure an adequate one. The past season has pointed out once again that the main factors regulating the kill are the movements and distribution of the caribou, about which man can do nothing. The question now is--when will the herd become too large for the range and move?

RECOMMENDATIONS

Both the hunting season and the bag limit for caribou in the Nelchina herd should be as liberal as feasible in order to best control the population.

Table 5. Hunters' choice regarding the bag-limit, as obtained from interviews of hunters at checking stations.

Hunters Checked		No Caribou		One Caribou		Two Caribou		Three Caribou	
		No.	%	No.	%	No.	%	No.	%
*325	Hunters refusing to take more caribou after taking.	56	17	161	50	82	25	26	8
	Thus 299, or 92 percent, of all hunters having the opportunity to fill their bag-limit of three caribou refused to do so.								
**777	Hunters who said they wanted to take. . . .	--	--	304	39	248	32	225	29

* Hunters checked that actually had the opportunity to take more caribou than they had already taken.
**Hunters asked to state how many caribou they wanted to take.

An adequate sampling technique for determining the annual caribou kill should be continued.

Prepared by:

Ronald O. Skoog
Wildlife Management Biologist

Approved by:

Robert F. Scott
Supervisor of Game Restoration

Date: April 30, 1958

JOB NO. 1(b): Sampling of Kill by Hunters--Steese-Fortymile Herd

PERIOD COVERED: August 15, 1957 to December 31, 1957

ABSTRACT

The 1957 hunting season resulted in a much reduced kill compared to previous years, however, individual hunter success was good, since approximately 55 percent of the hunters killed at least one caribou. Ninety-two percent of the kill was sustained on the Taylor Highway. The kill data are summarized below:

1. Total kill was 648 caribou.

2. Fifty-nine percent of the kill were males and 41 percent females.

3. Fairbanks hunters provided 68 percent of the hunting pressure.

4. Ninety-seven percent of the total kill were adults.

5. Hunting pressure during the highway crossing was down 50 percent from 1956.

6. Limit of three increased the kill approximately 13 percent during the period October 1-14 when the greatest hunting pressure occurred.

7. Non-resident hunters comprised 11 percent of the hunters in September and four percent in October.

8. Military hunters comprised only 11 percent of the total hunters.

9. Lack of hunting pressure was the main reason for reduced kill.

OBJECTIVES

To obtain data relative to sex and age composition, size of kill by hunters, and characteristics of the hunting season.

TECHNIQUES USED

During the periods when caribou were available to the hunter, a checking station was maintained at Mile 24 on the Taylor Highway.

Supplemental kill data were obtained from field contacts with hunters by enforcement agents, biologists, and assistant mammal control supervisors. A standard data form, used by all personnel involved, simplified the problem of obtaining the desired information and insured uniformity of reporting. Lack of caribou on the Steese Highway precluded the use of a checking station there during the season. Routine patrols, interviews with hunters and residents of this area were sufficient to determine the extent of the kill within useful limits. All field data and notes are located in the Federal Aid Branch files at the Fairbanks Office.

FINDINGS

The success of the caribou season in the Steese-Fortymile area is wholly dependent on the movement and distribution of the herds during the period August 20 to December 31. Caribou, in significant numbers, were not available from the Steese Highway at any time during the season except for occasional stragglers and small wandering bands in the vicinity of Twelvemile Summit and Porcupine Creek. During the first three weeks of September small numbers of caribou, primarily bulls, were available to the hunters on the Taylor Highway in the vicinity of Mt. Fairplay. Detailed kill data were obtained entirely from the Taylor Highway checking station and field checks.

Three definite phases evolved during the season:

1. August 20 to September 30 - when caribou (mostly bulls) were available on Mt. Fairplay.

2. October 1 to 14 - when the main herd migrated southeast across the highway.

3. October 15 to December 31 - after the main herd had gone and only stragglers remained.

The composition of the first two groups differed as well as the time and hunting conditions and are therefore treated separately.

Taylor Highway Area - August 20 through September 30, 1957:

Relatively light hunting pressure early in the season on the Taylor Highway did not warrant a full scale checking station effort, consequently, the data were obtained from hunter checks conducted during enforcement patrols in that area. Table 1 summarizes the information obtained during this period.

Many parties were totally unsuccessful; unfortunately, however, only partially or wholly successful parties were checked during this period. Table 1 is, therefore, only representative of successful

Table 1. Summary of caribou hunter kill data obtained on the Taylor Highway from August 20 through September 30, 1957

Number Parties Contacted			43	
Number Hunters			98	
Number hunters per party		2.3		
Number non-resident hunters(1)		11.0 (11%)		
Total Man Days of Hunting			332	
Number days per hunter		2.3		
Total Caribou Killed(2)			77	
Males		64.0 (83%)		
Females		13.0 (17%)		
Hunter Success				
Unsuccessful		44.0 (45%)		
Successful (at least 1 caribou)		54.0 (55%)		
1 caribou	35 (65%)			
2 caribou	15 (28%)			
3 caribou	4 (7%)			
Number caribou per hunter (all hunters)			.79	
Number caribou per hunter (successful hunters)			1.43	
Number caribou taken per man-day			.23	
Number hunters refusing 0 caribou(3)			89.	(91%)
Number hunters refusing 1 caribou(3)			5.	(5%)
Number hunters refusing 2 caribou(3)			4.	(4%)
Number hunters wanting 1 caribou			27.	(41%)
Number hunters wanting 2 caribou			20.	(29%)
Number hunters wanting 3 caribou			21.	(30%)

(1) 11 Non-resident hunters (11%) killed 21 caribou (18♂ - 3♀) or 27% of kill.

(2) All caribou were adults except for one yearling bull ♂.

(3) Caribou could have been shot but were not taken.

hunting parties. The success ratio for all hunters is undoubtedly somewhat lower than the figure given in the table. However, it provides a basis for evaluating the hunting pressure and conditions at this time. This year was the first time that detailed kill information had been gathered prior to the period when the caribou migrated southeast across the Taylor Highway in large numbers, and comparisons cannot be made directly with other years.

Of the total number of hunters checked, 55 percent were successful. Of these, 65 percent took one caribou; 28 percent took two; and only seven percent took three caribou. Very few hunters turned down caribou. Of the hunters checked, 29 percent wanted two and 30 percent wanted three caribou indicating that caribou were not readily available at this time. The limit of three served to increase the kill for this period; 30 percent over what it would have been had the limit been one and seven percent had the limit been two.

The number of caribou taken per man-day was only .23 as compared to .46 during the "caribou rushes" of 1955 and 1956 showing that almost twice the usual time and effort was expended to obtain caribou during this period. If unsuccessful parties had been included this figure would have been even lower.

Contrary to expectations, non-resident hunters comprised a minority segment of the hunters as a whole (11 percent). They took 21 (27 percent) of the 77 caribou taken at this time. Six (54 percent) of the non-resident hunters were accompanied by guides and the rest were hunting on their own or with resident hunters. They were primarily interested in trophies as shown by the fact that 18 out of 21 caribou taken by non-residents were bulls and most of the meat given to local residents and natives.

Hunter checks were not conducted every day during this period, therefore, the known kill data are extrapolated to cover the entire period to determine the total kill. To obtain this figure it was necessary to divide the period into two segments. The take between August 20 and September 13 averaged 5.5 caribou per day. After this date most of the caribou in the area moved away from the highway and the take dropped to 1.3 per day for the period between September 14 and September 30. No caribou were taken between October 1 and 3. By multiplying the average daily take by the number of days in each period, the total take was calculated to be 162.

The kill for the entire period was 83 percent males and 17 percent females due, primarily, to a movement of bull caribou drifting slowly west and north across the highway during September prior to the rut. Lesser numbers of young bulls, cows, calves, and yearlings were also available, however, hunter selectivity favored the adult

bulls. Early in the season, prior to the rut, hunters tend to try for the biggest caribou they can find. Only one yearling and no calves were taken by hunters checked during this period.

Taylor Highway - October 4-13, 1957: The heaviest hunting pressure of the season occurred during the migration southeast across the highway between the Dawson "Y" and Eagle (see Job 2(b). The checking station was maintained at Mile 24. Table 2 summarizes the hunter success information obtained at this time.

Despite the fact that caribou were available hunting pressure was 50 percent less than in 1956. Only 347 hunters were checked through the station in 10 days (34.7 per day) as compared to 876 in 13 days in 1956 (67.4 per day). There are two reasons which probably account for the reduction in hunting pressure.

1. Competition with the Denali Highway area where caribou were available via better roads and a shorter distance from home.

2. Generally inclement weather which threatened to close the highway to traffic.

Hunter success (hunters taking at least one caribou) was 54 percent, slightly less than in 1956, and on a par with 1954 and 1955. In 1954, 54 percent were successful; 61 percent in 1956; and 55 percent in 1955. It is apparent that when caribou are readily accessible, such as during the highway crossing, hunter success can be expected to run between 50 and 60 percent on the Taylor Highway.

The percentage of hunters who got caribou did not change significantly, however, the individual hunters success was considerably better. Success measured in number of caribou taken per man (total hunters) increased from .69 in 1956 to .96 in 1957. In terms of number of caribou per successful hunter, the number rose from 1.1 in 1956 to 1.8 in 1957. There was also a significant increase over 1956 in the number of hunters who took two or three caribou. In 1956, 87 percent of the successful hunters took one caribou and 13 percent took two. In 1957, however, 47 percent of the successful hunters took one caribou; 23 percent took two; and 25 percent took three caribou. Hunters wanting one caribou were 33 percent; 27 percent wanted two; and 43 percent wanted three. It is obvious that of the successful hunters those wanting one or two caribou were usually satisfied, however, those desiring the full limit of three had to settle for less in some instances. It should be pointed out that often it was lack of transportation rather than the lack of caribou that prevented more from being shot.

Table 2. Summary of caribou hunter kill data obtained on the Taylor Highway from October 4 through October 31, 1957

Number Parties Contacted		151.	
Number Hunters		347.	
Number hunters per party		2.3	
Number non-resident hunters		12.	
Total Man Days of Hunting		631.	
Number days per hunter		1.8	
Total Caribou Killed		332.	
Males	19 (59%)		
Females	133 (41%)		
Sex Unknown	8		
Hunter Success			
Unsuccessful	160 (46%)		
Successful (at least 1)	187 (54%)		
1 caribou	88 (25%)		
2 caribou	53 (16%)		
3 caribou	46 (13%)		
Number caribou per hunter (all hunters)		.96	
Number caribou per hunter (successful hunters)		1.8	
Number hunters wanting 1 caribou		115.	(33%)
Number hunters wanting 2 caribou		82.	(24%)
Number hunters wanting 3 caribou		150.	(43%)

NOTE: Limit of 3 increased kill 13% in excess if limit was 2.
Limit of 3 increased kill 44% in excess if limit was 1.
Limit of 2 increased kill 35% in excess if limit was 1.

Success measured in "caribou taken per man-day" remained about the same as in past years. In 1955 and 1956, .46 caribou were taken per man-day and .45 in 1957. It may be said then, conservatively, that the average hunter expends two days of effort to obtain a caribou. Non-resident hunters were definitely in the minority during this period. Only 12 (4 percent of the total number of hunters) were checked through the station. These 12 hunters bagged nine caribou. Five hunters were residents from the States and seven were local residents who had not been in the territory for 12 months. None of them had guides. It is very evident that the abolition of the guide requirement had little or no effect on the number of non-resident hunters taking to the field on their own.

The largest proportion of the hunting pressure on the Taylor was provided by hunters from Fairbanks, nearby suburbs, and the military bases at Ladd and Eielson. Hunters from Tok and the Anchorage-Palmer areas provided most of the remaining pressure. Table 3 shows the various sources of hunting pressure and the proportion of hunters from each locality. The proportion of military hunters was only 11 percent as compared to 30 percent in 1955 and 1956. There are two possible reasons for the reduced number of military hunters: "Operation Gyroscope" reduced the number of military hunters eligible for resident licenses and the use of military vehicles for hunting was drastically curtailed by official order.

The pattern of the migration across the Taylor Highway shifted again for the third year. In 1955, the crossing took place largely between Mile 20 and 110; in 1956 it occurred between Mile 85 and 141. In 1957 it was restricted between Mile 105 and 152. The Dawson-Eagle "Y" areas and Polly Summit, scene of the largest percentage of the take in 1956, produced only 12 percent of the kill. Thirty-one percent were taken between Columbia Creek and Liberty Creek. The greatest proportion of the kill was effected between Liberty Creek and American Summit where 53 percent were taken. The remaining four percent were taken between American Summit and Eagle. Figure 1 shows the distribution of the kill on the Taylor Highway.

Crippling losses were almost neglible as compared to previous years. Only four abandoned kills were found in the hunted area amounting to slightly more than one percent of the total take during this period. Large bands of caribou were seldom encountered by hunters, and the scenes of wholesale slaughter were not as prevalent as in previous years. Crippling losses under existing circumstances are almost impossible to assess accurately. Due to the low hunting pressure and the scattered character of the highway crossing, it is estimated that the total loss was not more than five percent. This figure has been applied to the entire kill for the current season.

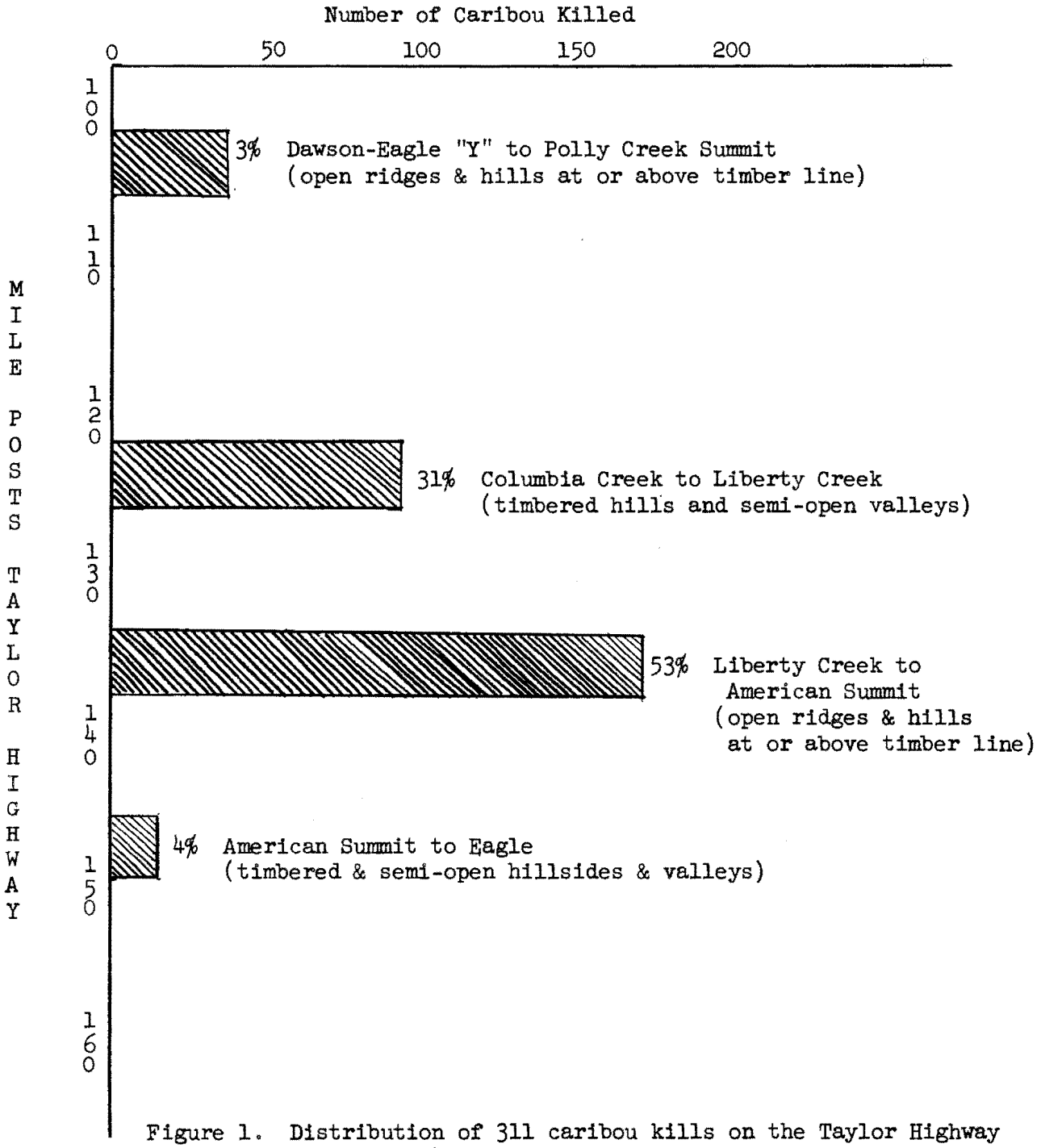


Figure 1. Distribution of 311 caribou kills on the Taylor Highway October 1-14, 1957.

Table 3. Residence of hunters hunting from the Taylor Highway October 3 to 14, 1957

AREA	NUMBER	PERCENT
Fairbanks	181	68%
Ladd	7	
Eielson	14	
Tok and adjacent communities	43	15%
Eagle	8	3%
Anchorage-Palmer-Valdez-Elmendorf	32	11%
Ft. Greely	8	3%
Haines	1	
TOTAL	294	100%
Civilian	263	89%
Military	31	11%
	294	100%

From October 1-14, 59 percent of the kill were bulls and 41 percent cows. It is obvious that the sex ratio of the kill during this period was different from that obtained during September when all segments of the herd were not available to the hunter. In October the bull:cow ratio for the kill was 142:100 as compared to 484:100 in September. The composition of the kill during the rut seems to be fairly constant. In 1956, during this period, the bull: cow ratio was 150:100. At a time when most of the elements of the Nelchina herd were together in the Denali area in 1956, the bull:cow ratio was 138:100.

A sample of 90 lower jaws from caribou two years or older (40 male and 50 female) were collected at the checking station. In addition, all calves and yearlings were recorded, however, no jaws were collected from this class. Age was determined on the basis of tooth eruption and wear. The data were combined to indicate the age structure of the total kill during this period (Table 4). The kill was primarily composed of adults (individuals 2 years or older) as was the case in 1956. Calves and yearings comprised only three percent of the kill. There has been a downward trend in these two classes since 1954 when calves alone made up six percent of the kill. This is in sharp contrast to the 1956 take in the Nelchina where 26 percent of the kill was calves and yearlings. Although hunter selectivity favors adult caribou, it appears that the current take reflects the poor survival of calves to the yearling stage.

Stomach samples were again collected from caribou taken by hunters. They will supplements the samples collected in previous years during the same period which are presently being analyzed by Alan Courtright at the University of Alaska. Reproductive tracts from three adult females were also collected. Attempts to have hunters collect reproductive tracts met with total failure, since they are unable to recognize what they are looking for.

Taylor Highway - October 15 to December 31, 1957: Hunting during this period was limited to the occasional hunting party. Enforcement patrols served to furnish information on the number of caribou taken. A known kill of 37 caribou was tallied. It was estimated that an additional 38 caribou were taken for a total kill of 75 which includes a five percent crippling loss.

Caribou were almost totally unavailable after October 20, however, a few stray bands continued to wander back and forth across the highway during the remaining season and the few hunters in the area managed to take caribou occasionally. No attempt was made to obtain any data other than the number killed.

Table 4. Age distribution* of caribou carcasses checked at the Taylor Highway checking station October 1-14, 1957

	PER CENT COMPOSITION		
AGE	MALE	FEMALE	TOTAL
Calf	0	2	1
Yearling	3	1	2
	3	3	3
2 yrs.	7	6	7
3 yrs.	15	17	16
	22	23	23
4 yrs.	38	35	37
5 yrs.	15	22	18
	53	57	55
6 yrs.	5	6	5
7 yrs.	7	6	7
	12	12	12
8 yrs.	5	4	4
9 yrs.	5	1	3
	10	5	7
	100	100	100

TOTAL KILL: 191 Males
133 Females
324

* Based on sample of 90 lower jaws from caribou older than one year. Calves and yearlings aged by inspection.

SIZE AND STRUCTURE OF TOTAL KILL

The total kill of caribou from the Steese-Fortymile caribou herd was 648 animals, the smallest take since 1954. This includes both the Steese and Taylor Highway areas plus an estimated five percent crippling loss. Ninety-two percent of the kill occurred on the Taylor Highway and eight percent on the Steese Highway. Fifty-eight percent of the Taylor Highway kills occurred October 1 to 13. A summary of the total take of caribou from the Steese-Fortymile herd for the past four seasons is presented in Table 5.

The sex ratio for the entire kill is presented in Table 6. Since the sex ratio for the early part of the season varied considerably from that obtained during October, it is necessary to use weighted values to determine the final sex ratio for the entire kill. Sex ratios were not available from the limited kill on the Steese Highway and the kill after October 14 on the Steese. It can, however, be assumed that the sex ratio for the former was similar to that obtained for September on the Taylor, since most of the caribou taken from the Steese were taken during August and September under similar circumstances. There is no reason to believe that sex ratios would change materially during the period immediately after October 14 on the Taylor, since most of the estimated 75 caribou taken between October 14 and December 31 were killed prior to October 30. The final results show that 66.8 percent of the total kill were bulls and 33.2 cows. This is very similar to the Nelchina areas in 1956 where 64.4 percent of the kill were bulls and 35.6 were cows. The sex ratio of the 1956 kill in the Fortymile was 60 percent bulls and 40 percent cows.

The only detailed age data available is that obtained during the period October 1-14. Although it seems reasonable to assume that this sample is characteristic of the kill for the rest of the season, lack of information prohibits definite conclusions. The lack of calves and yearlings in the kill, both early and late in the season, suggests some similarity however.

The age distribution of the kill indicates a weakening of the younger age class. When compared with similar data from the Nelchina this fact becomes quite evident. In the Nelchina in 1956, 64 percent of the animals killed were less than four years old. In the current Fortymile kill, only 26 percent were less than four years old.

RECOMMENDATIONS

To obtain data relative to sex and age composition, size of kill by hunters, and characteristics of the hunt.

Table 5. Record of caribou killed annually in Steese-Fortymile area 1954-1957.

AREA	YEAR			
Steese Highway	1954	1955	1956	1957
Known kill	605	54	14	38
Est. total kill (1)	850	150	100	50 (4)
Taylor Highway				
Known kill	379	1577	607	446
Est. total kill (1)	850	2175 (2)	742 (3)	598 (4)
Above Areas Combined				
Est. total kill	1700	2325	842	648

1. Estimated total take includes additional kills not accounted for at the checking station.
2. Includes 20 percent crippling loss.
3. Includes 10 percent crippling loss.
4. Includes 5 percent crippling loss.

Table 6. Computed sex ratio for 1957 hunter take from the Steese-Fortymile herd - Taylor Highway.

SEX	Aug. 20 - Sept. 30 Number	Percent	Oct. 1 - Dec. 30 Number	Percent	SEX RATIO OF TOTAL KILL (Weighted Percentages)
Male	64	83	193	59	(.328)(83) + (.672)(59) = 66.8%
Female	13	17	133	41	(.328)(13) + (.672)(41) = 33.2%
TOTAL	77	///	326	///	
TOTAL KILL	162		332		494
Weight Factor	$\frac{162}{494}$ = .328		$\frac{332}{494}$ = .672		

Prepared by:

SIGURD T. OLSON
Wildlife Management Biologist

Approved by:

ROBERT F. SCOTT
Supervisor, Game Restoration

Date: February 20, 1958

JOB NO. 2(a)--Movements, Distribution, and Numbers--Nelchina Herd

PERIOD COVERED: April 1, 1957, to March 31, 1958

ABSTRACT

Movements by the Nelchina caribou during the past year continued to reflect the western shift in range use evident in recent years. The previously favored wintering grounds on the Lake Louise-Ewan Lake flats have become almost deserted, and only a few thousand caribou wintered there during 1957-58. The bulk of the herd utilized the Deadman-Nadiwen Lakes region for much of the year, although the foothills of the Talkeetna Mountains remained important during spring and early summer. For the first time in recorded history a major portion of the herd wintered along the Talkeetna River, with bands extending as far west as Rainbow Lake. The Monahan Flat also was utilized by moderate numbers of caribou. This westward shift is considered beneficial as concerns range use, but its cause is unknown.

A census was not feasible due to the herd's distribution, but an estimate of total size was made by utilizing productivity and mortality data. At present the herd probably contains at least 45,000 animals.

OBJECTIVES

To record the seasonal distribution and patterns of movements of the Nelchina caribou herd, and to obtain as accurate an estimate of total numbers as possible.

TECHNIQUES USED

Periodic aerial surveys were used to trace the movements and distribution of the herd throughout the year, the resulting data being supplemented by information gained from local observers and from cooperating FWS personnel. An intensive aerial census was planned tentatively for late winter to obtain an estimate for total numbers.

The data on movements used for this report are filed in the Anchorage office of the Federal Aid to Wildlife Restoration Branch.

FINDINGS

Movements and Distribution.

The Nelchina caribou continued their recent shift of range use to the westward during 1957. This shift was first noticeable during the winter of 1955-56, when a large portion of the herd used the Deadman Lake region instead of the customary wintering grounds on the Lake Louise flats. The westward tendency continued during 1956-57 and few caribou wintered on the flats; most of the herd remained in the Deadman Lake region, with other western concentrations occurring near Cantwell and along the Talkeetna River, although one segment did winter in the Paxson-Tangle Lakes area. Figure 1 shows the distribution of caribou in March, 1957. The approximate numbers of caribou in each of the four concentration areas were as follows: Paxson--5,000 ±; Talkeetna River--1,000 ±; Deadman Lake--20,000 ±; and Cantwell--2,000 ±. The discussion which follows traces the seasonal movements of the herd from these concentration points in March, 1957, through the year to March 31, 1958. The movements and distributions described refer mainly to those involving a large portion of the herd. Stragglers and stray bands, of course, commonly occur throughout the range at just about any time of the year.

Spring. Early in April the calving groups from the Cantwell area began moving southward. Most traveled up the Jack River, up Soule Creek and across to Brushkana Creek, and then down Deadman Creek toward Deadman Lake. Another segment moved eastward up the Nenana River, across Seattle Creek to Brushkana Creek, and southward toward Deadman Lake. These groups became mixed with the "Deadman Lake caribou" and thus lost their identity as the "Cantwell group". Most of the animals near Cantwell had left that area by mid-April, although bulls were still common along the Nenana River and along Wells Creek as late as mid-May.

By mid-April the calving groups from all areas had begun the move toward the calving grounds. Caribou from the Deadman Lake region moved southward across the Susitna River mainly near the mouths of Fog and Watana Creeks. One segment passed near Stephan Lake and onto the upper Talkeetna River; another moved up Fog Creek, crossed to Tsisi Creek, and passed down that stream to Kosina Creek; and a third crossed the Susitna to Watana Lake and proceeded up Kosina Creek. Caribou along the Talkeetna River moved northeastward in late April and early May toward Kosina Creek via Tsisi and John Creeks, the latter a tributary to the head of Kosina. The largest

portion of the animals wintering in the Paxson area left there in mid-April and traveled westward past Monsoon Lake, across the Susitna just below the Maclaren River to the head of Jay Creek, and then moved southward across the Susitna again to Kosina Creek. Other portions of the "Paxson caribou" swung south after reaching Monsoon Lake in early May and moved slowly southwestward through the timbered country toward Lone Butte: one segment swung past the Butte, with some moving up the Oshetna River and others crossing to Goose Creek; another segment swung up Sanona and Tyone Creeks. Bulls and non-calving groups were still common in mid-May in all of the wintering areas mentioned.

In early May a large portion of the herd was funneling into Kosina Creek, concentrating mostly near the mouths of Tsisi and Gilbert Creeks. This portion, composed of over 15,000 animals, mostly cows and young stock, began streaming southeastward in long single-files, and by May 12 stretched from Kosina Creek to the Little Nelchina River. Two main concentration points occurred during the calving period from mid-May to early June: one at the heads of Sanona and Tyone Creeks and another at the heads of Gilbert and Goose Creeks. Caribou extended in all directions from these two points, however, and some still remained near the wintering areas. Figure 1 shows the generalized movements and concentration areas occurring during the spring.

Summer. In early June the calving groups in the main calving areas began drifting southward. Those at the heads of Gilbert and Goose Creeks moved to the hills between the Oshetna and Little Oshetna Rivers, while those at the heads of Sanona and Tyone Creeks moved to the upper portions of the Little Nelchina River and Caribou Creek. Both groups intermingled, and the main concentration in mid-June, then, extended from upper Caribou Creek northward to the Oshetna Rivers. By that time many adult bulls had mixed with the calving groups. Figure 2 shows the approximate location of the area described.

A strong northward movement began in late June and continued intermittantly through July and early August. Most of the caribou crossed the Susitna River in late July and spread out over the Deadman-Nadiwen Lakes region during August. One group of several thousand, containing many bulls, remained to the south, dispersed mainly over the area from the head of Tyone Creek to the Oshetna River. Groups extended south to the Glenn Highway and north to the Denali Highway, and many bands were still straggling northward between the Black and Susitna Rivers in late August. Some animals were present near

Stephan Lake and along the upper Talkeetna River, others occurred along the lower Tyone River, and a few extended eastward along the Maclaren River and the Denali Highway. Figure 2 shows the main concentrations in late August.

Fall. September witnessed a considerable shifting of the Nelchina caribou. Animals in the Oshetna-Tyone area began drifting northward at the end of August, and by mid-September they had reached the Clarence Lake-Goose Creek region, intermingling there with groups from the Deadman-Nadiwen concentration area. Meanwhile, other caribou from the latter area had moved to the west and had dispersed at the heads of Soule, Brushkana, and Tsusena Creeks, and on September 17 another group, composed of some 10,000 animals, was moving eastward along the Maclaren River. Figure 3 shows these early and mid-September distributions.

The shifting continued during late September and early October, and most of the caribou returned to the Deadman-Nadiwen Lakes region. About 2,000 of those along the Maclaren River swung southward onto the northern portion of the timbered flats between the West Fork of the Gulkana River and Ewan Lake; the rest returned westward. One segment of several thousand from the Clarence Lake group moved up Tyone Creek into the area just north of Eureka; all but about 1,000 returned northward in late October. Figure 3 shows the three main concentrations occurring in late October. All contained cows and calves, although the group on the West Fork-Ewan Lake flats included many adult bulls, also.

Winter. These three concentrations remained through November and December and except for minor changes covered generally the same areas. The Deadman-Nadiwen group, however, which included the bulk of the herd, had spread northward and southward to include the Monahan Flat and the Fog Lakes, respectively. The Eureka group moved to the northwest in late October and settled at the upper ends of Hicks, Caribou, and Flat Creeks. The third group remained essentially in the same area, although isolated groups extended to many parts of the Lake Louise flats. Figure 4 shows the caribou distribution during November and December.

In late December and throughout January all but about 5,000 of the caribou in the Deadman-Nadiwen area moved southwestward onto the upper Talkeetna River. Most moved up the left bank of the Talkeetna, many extending southward to the head of the Chickaloon River and others westward to Rainbow Lake. Many animals settled in the hills between Iron Creek and the Talkeetna River and along the

creeks entering the Talkeetna from the east. Caribou tracks, trails, and feeding areas thoroughly covered the whole basin of the Talkeetna River. By mid-February the movement had reversed and caribou turned northward again. The other two concentration areas noted in November remained unchanged. Figure 4 shows the major movements and distribution of the Nelchina caribou during January and February.

The northward movement from the Talkeetna River continued during early March. By the middle of the month more than 10,000 animals were scattered over the hills lying south of Fog Lakes, but many still were present along the upper Talkeetna River, also. The main concentration areas in mid-March included the following numbers of caribou: Deadman-Nadiwen Lakes--5,000 /; Talkeetna River-Fog Lakes--20,000 /; Caribou Creek--1,000 /; and West Fork-Ewan Lake --2,000 /. In late March these concentrations remained largely unchanged, but movements of calving groups had started eastward toward Kosina Creek from the Talkeetna River-Fog Lakes area. Figure 5 shows the distribution and movements during March, 1958.

Discussion. The continued extensive use of the western half of the range by the Nelchina caribou herd became increasingly evident during 1957. The animals now seem to have all but deserted the previously favored wintering grounds on the Lake Louise-Ewan Lake flats. Instead, the Deadman-Nadiwen Lakes region has become more and more important both as a summering and a wintering area, although the foothills of the Talkeetna Mountains still are important during the spring and summer. For the first time in recorded history a major portion of the herd wintered along the Talkeetna River, with some bands extending even west of Rainbow Lake. A fair number of caribou also wintered on the Monahan Flat. The cause of this westward shift is not known, but it certainly benefits the range by dispersing the caribou's effect on the vegetation. Range studies during the summer of 1957 indicated that the lichens on the Lake Louise flats were not in too good condition and probably needed a rest. Perhaps the caribou in their own way know more about range management than we do?!

Total Numbers.

The intensive census of the Nelchina herd planned for the winter of 1957-58 proved not feasible, because of the caribou's distribution. With the herd scattered over such a wide area and in such rugged terrain as they were last winter, a sampling technique that could census the herd practically, without too great a sampling error, seemed almost impossible. Total counts also were not

possible, because of the excessive flying time and number of personnel needed for such a venture.

The last census was made in March, 1956, and the total herd size was estimated at 40,000. Since then the herd has had two large calf crops (totaling about 24,000 calves), with good survival (about 60 percent) during the mild winters that followed. Hunters have killed only about 6,000 animals during the same period--probably much less than the annual increase. Unless sizeable numbers of caribou have moved off the range, the herd now should number at least 45,000 animals. FWS personnel have watched the herd closely, however, and, although some caribou could have left the range unnoticed, most probably remained. Perhaps a census next winter will establish the present size.

RECOMMENDATIONS

Movements of the Nelchina caribou herd should be followed closely in order to determine the seasonal movement patterns and seasonal range utilization, and to record any ingress or egress of animals.

An intensive census should be made when feasible to determine the present size of the herd.

Prepared by:

Ronald O. Skoog
Wildlife Management Biologist

Approved by:

Robert F. Scott
Supervisor of Game Restoration

Date: April 30, 1958

FIGURE 1. Caribou distribution and movements--March to early June, 1957.

Wintering grounds: March

Movements: April to mid-May

Calving grounds: mid-May to early June

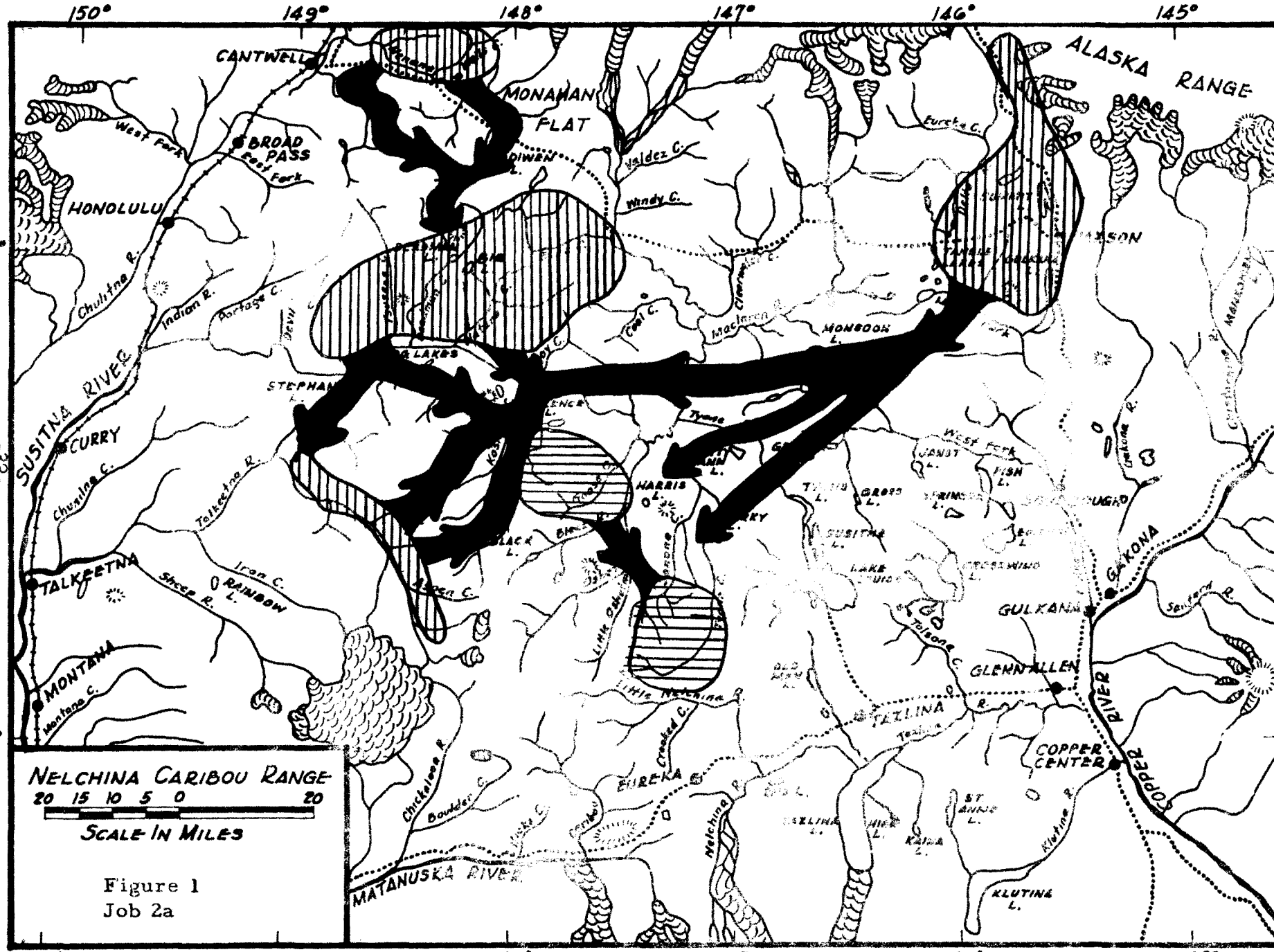
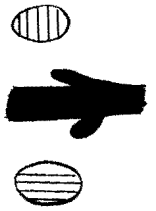


Figure 1
Job 2a

FIGURE 2. Caribou distribution and movements--mid-June to late August, 1957.



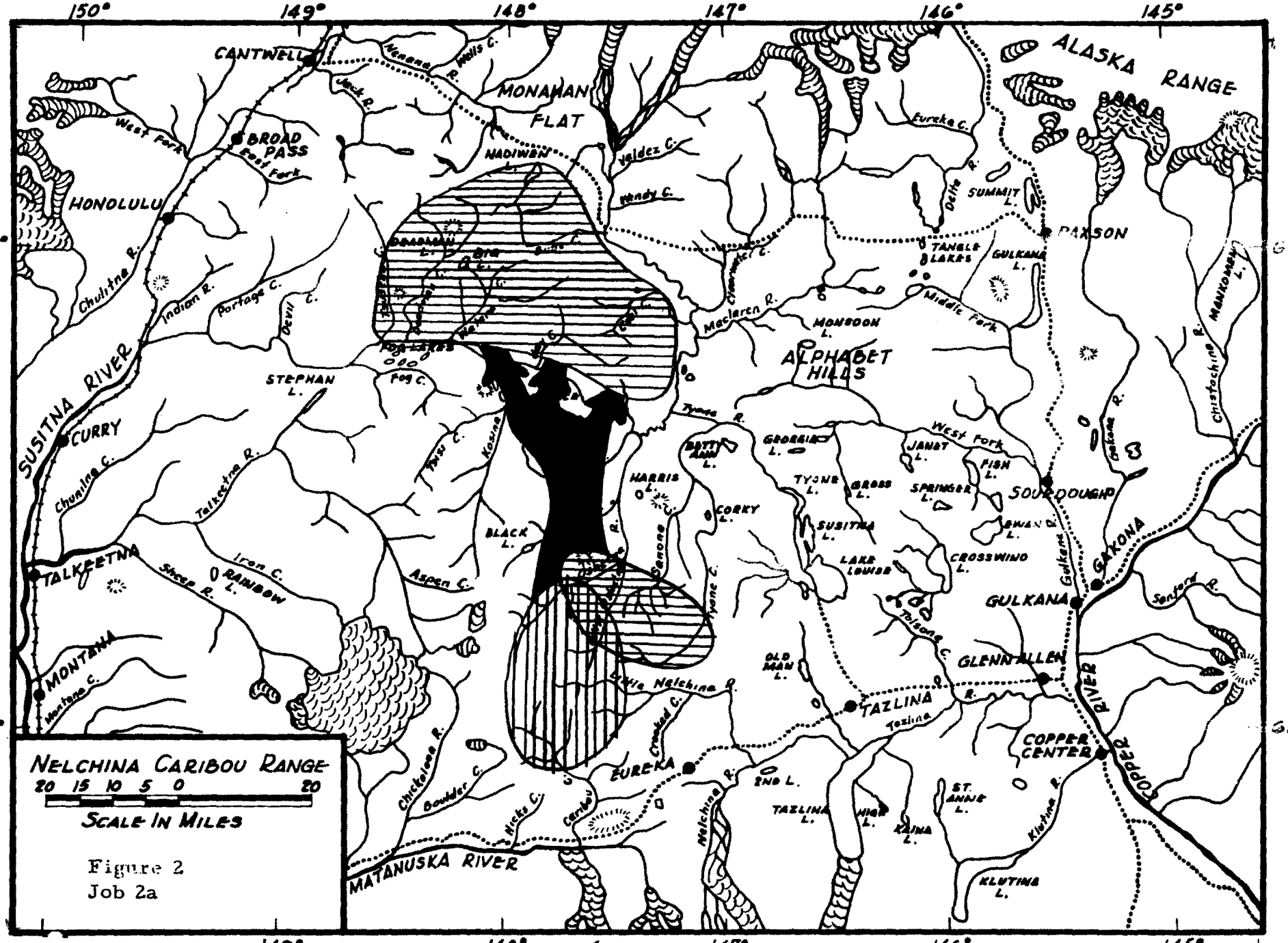


Figure 2
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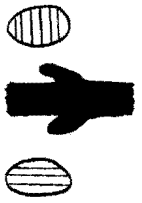
FIGURE 3. Caribou distribution and movements--September to October, 1957.



Concentration areas: early and mid-September

Movements: early September to early October

Concentration areas: October

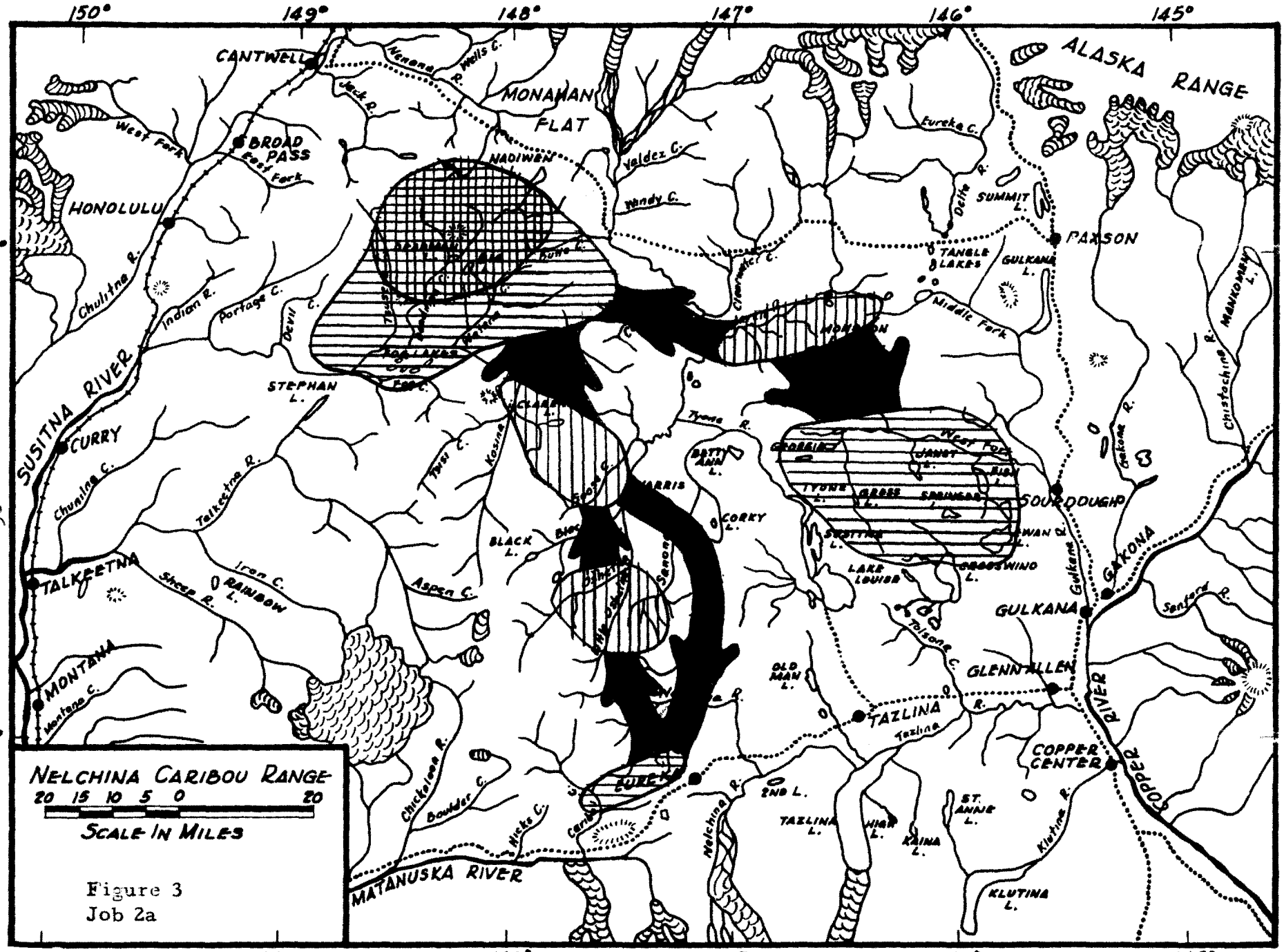
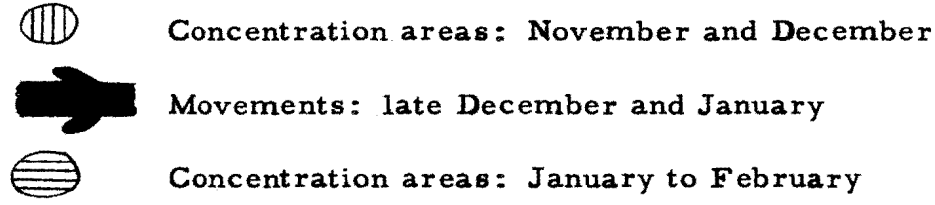


Figure 3
Job 2a

FIGURE 4. Caribou distribution and movements--November, 1957, to February, 1958.



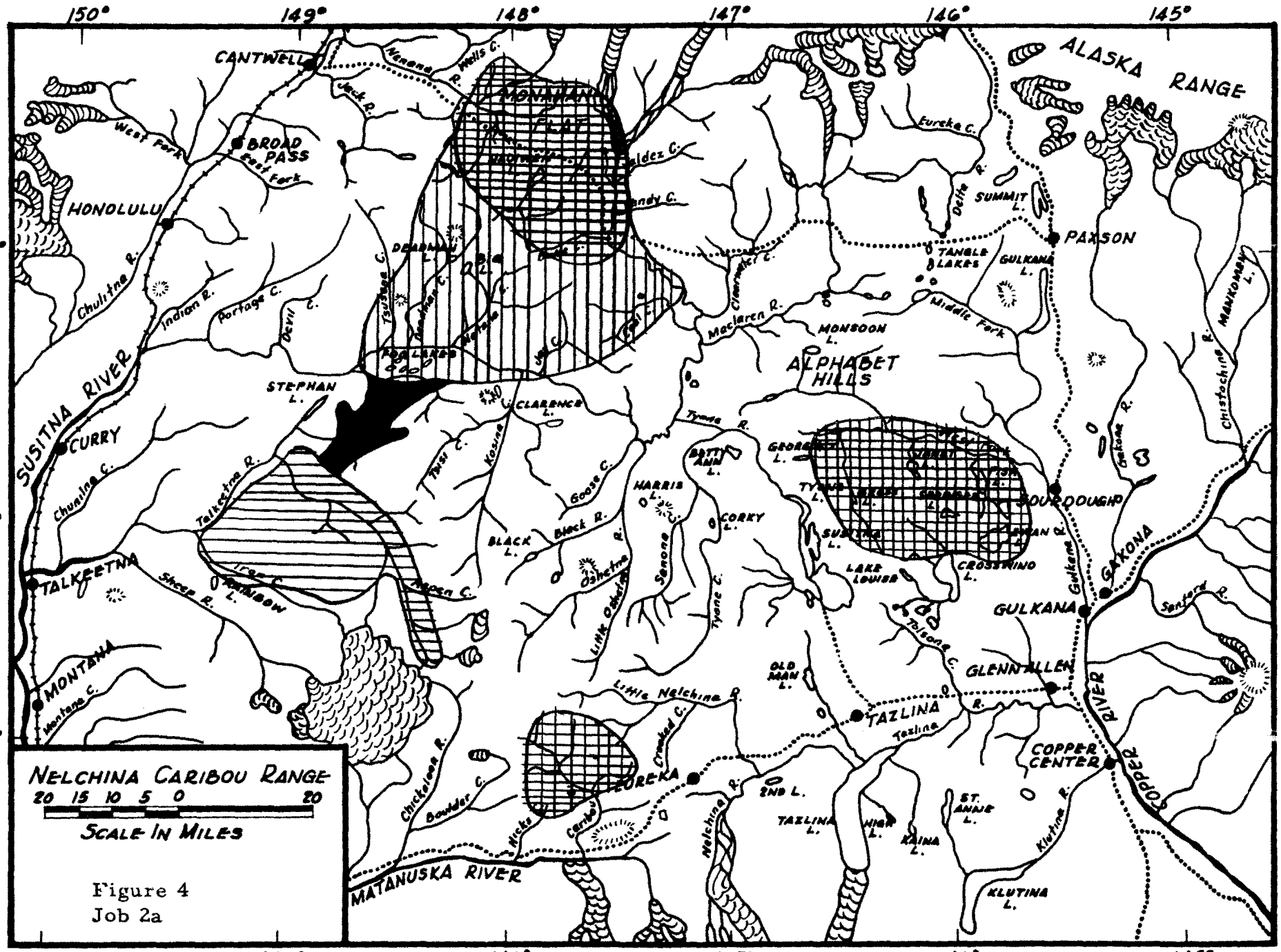


Figure 4
Job 2a

FIGURE 5. Caribou distribution and movements--March, 1958.

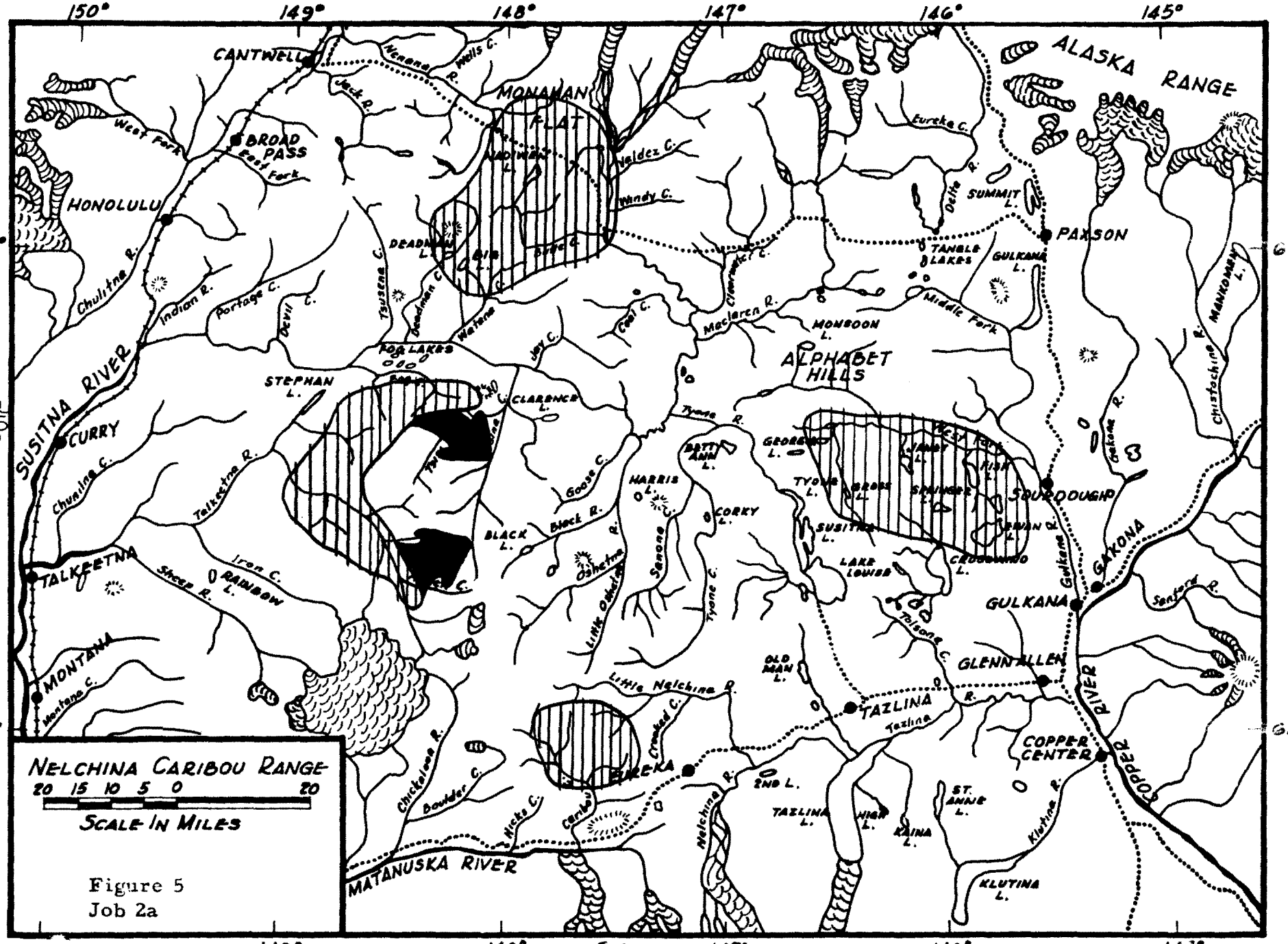


Figure 5
Job 2a

JOB NO. 2(b): Movements, Distribution, and Numbers--Steese-Fortymile Herd

PERIOD COVERED: May 1, 1957 to April 15, 1958

ABSTRACT

The calving segment of the herd moved northwestward to the Charley River and White Mountain areas in May. Immediately after calving, a general wide dispersal over the summer ranges occurred between the Steese and Taylor Highways. No large concentrations or significant movements were observed during the summer months. By late September most of the caribou had begun to move southeast and by October 20 most of the herd had crossed the Taylor Highway and moved into Canada toward the Ogilivie Mountains east of the Yukon, and into the lower Sixtymile River. A small group of caribou, numbering approximately 2000 wintered between Beaver Creek and the Yukon flats near Circle. A similar sized herd ranged between the Sixtymile River, the Ladue, and White Rivers. The whereabouts of the main herd was not discovered during the winter.

OBJECTIVES

To determine distribution and gains and losses due to movements and trace seasonal migrations.

TECHNIQUES USED

Periodic reconnaissance flights were made during the year to discover and trace caribou movements as well as to locate stationary groups. In addition, reports from BSF&W personnel working on other projects, the Cooperative Research Unit at the University of Alaska, private and commercial pilots, and residents of the area were used to supplement the aerial observations. Sixty-four hours of flying time were spent primarily on this project.

FINDINGS

Movements and Distribution: Spring - The Steese-Fortymile caribou herd was widely scattered prior to calving. Flights during early April showed an estimated 2000 caribou spread out over the drainages of the upper Chena River, Preacher Creek, Porcupine Dome, Birch Creek, and the lower Charley River. It was obvious that the main portion of the herd has not yet returned to the Steese-Fortymile area as there were no caribou elsewhere in the area. On

May 1 and 2, what few caribou there were in the area were drifting into the area south of Birch Creek between the head of the Chena River and the south fork of Birch Creek.

The movement of caribou out of Canada occurred during the first week in May prior to break-up. Caribou were observed crossing the Yukon downstream from the Chandindu River almost to the Alaskan border by Mr. Pat Callison, pilot from Dawson City, Yukon Territory. Miners at Fortymile reported large numbers of caribou moving across the Yukon May 12-15. This movement funneled into the Fortymile River region and continued westward into the area drained by the south and west forks of the upper Charley River where a large segment of the migration halted and spread out to calve. Calving was in progress on May 26 when this development was first discovered. Caribou, however, were still moving along well defined trails toward the White Mountains as of this date. An estimated 5000 (including the 2000 caribou which wintered in Alaska) crossed the Steese Highway between Mile 82 and Twelvemile Summit during the period May 20-26. The latter apparently came into the Charley River drainage from Birch Creek and, moving clockwise, joined or preceeded the caribou from Canada. Once across the Steese Highway the movement proceeded to the divide between Beaver Creek and Preacher Creek where it stagnated and spread out into small groups to calve. By June 5 calving was over and large groups of cows, calves, yearlings, and a few bulls were traveling toward Eagle Summit. The first bands crossed on June 7. By June 19 the movement out of the White Mts. was completed and this segment of the herd was headed toward summer ranges. On June 10 an aerial check of the calving area on the Charley River revealed that the group which had previously occupied this area had left.

Summer - Caribou spread out over the entire Steese-Fortymile area during the summer months. No large groups of caribou were located and no significant movements were detected between June and late August. An estimated 500 caribou bulls heading northwest crossed the Taylor Highway near Mount Fairplay the last ten days of August according to reports from Burt Libby of the University of Alaska and BSFW personnel working in the area at this time.

Fall - Caribou began to congregate during the September rut between the head of the Salcha River and Glacier Mountain. By September 25 they were moving toward the Taylor Highway between Fortymile River and Eagle. The head of this movement numbering 1000 to 1500 individuals, crossed en masse at Liberty on September 28. Within the next two days 2000-3000 head had crossed between O'Brian Creek and American Summit. The movement spread out during the next ten days and caribou were observed crossing at many points

between Polly Creek Summit and Mile 105 and American Creek. With the exception of the first two days the caribou bands seen ranged in size from less than five individuals to 200. Thirty-three bands tallied averaged 16 head per band. There were no large concentrations observed anywhere. By October 23 the migration had cleared the Taylor. Flights made on October 7, 15, 23, and 25 showed that most of the herd had swung southeast after crossing the Taylor Highway and either crossed the Yukon into Canada or headed across the Dawson Road into the Sixtymile country. The Yukon was crossed at several places; Miller Camp, Nation River, and Fortymile being some of the more noticeable crossing points. The migration route was lost at this point due to weather. Canadian observers did not report any significant numbers of caribou moving into the area around Dawson during October and November, and it is assumed that they moved into the Ogilivie Mountains to the east. Approximately 2000 caribou remained in Alaska and moved into the area between Porcupine Dome and Victoria Mountain. The groups that crossed into the Sixtymile spread out across the lower Ladue River as far southeast as the White River.

Winter - Very few caribou wintered on the Alaskan side of the Steese-Fortymile range. The caribou seen on the Preacher and Beaver Creek drainages in October gradually broke up and scattered out from the drainage of Beaver Creek to the flats between Circle City and Circle Hot Springs. On January 15, 600-700 were observed between Porcupine Dome and the Crazy Mountains. Another 300 were spread out over the Yukon flats between Circle Hot Springs and the Yukon River. There were no caribou found wintering anywhere on the drainages of the Charley, Salcha, Goodpaster, or Fortymile Rivers. An isolated group of 170 caribou were noted on the head of the Seventymile River in January.

An extensive aerial search, in early February, revealed 2000 caribou wintering in the area between the Ladue and lower Sixtymile River primarily on the Canadian side. Less than 1000 caribou were found east of the Yukon between the Steward River and the Ogilivie River. The location of the rest of the herd was not discovered. Distribution had not changed appreciably by late April 1958.

During the year, there was no opportunity to determine total numbers. Highway crossings occurred under conditions which did not permit even approximate counts. The nature of the fall crossings, i.e., small size of bands, and the scattered erratic movement pattern, suggested that considerably fewer caribou crossed than in previous years.

There are two possible reasons for this assumption:

1. Part of the herd may not have returned from Canada last spring.

2. The reduced calf crop of the past two seasons could have contributed to a reduction of numbers.

It is becoming increasingly obvious that the Steese-Fortymile herd has recently deviated significantly from its usual distribution pattern and movements. The reduced calf crop will certainly result in static or decreasing numbers in comparison to previous years. Total numbers would also change noticeably if the herd begins to break up and some segments perhaps join Canadian herds. The latter possibility is very real, since during the winter that part of the herd which crossed the Yukon could very easily have joined Canadian herds ranging in the Ogilivie Mountains.

Movements and distribution of caribou during the past year are shown in Figures 1, 2, and 3.

RECOMMENDATIONS

Aerial reconnaissance designed to record movements and distribution should be continued, since the status of the herd is apparently changing with respect to both numbers and distribution.

Prepared by:

SIGURD T. OLSON
Wildlife Management Biologist

Approved by:

ROBERT F. SCOTT
Supervisor, Game Restoration

Date: April 17, 1958

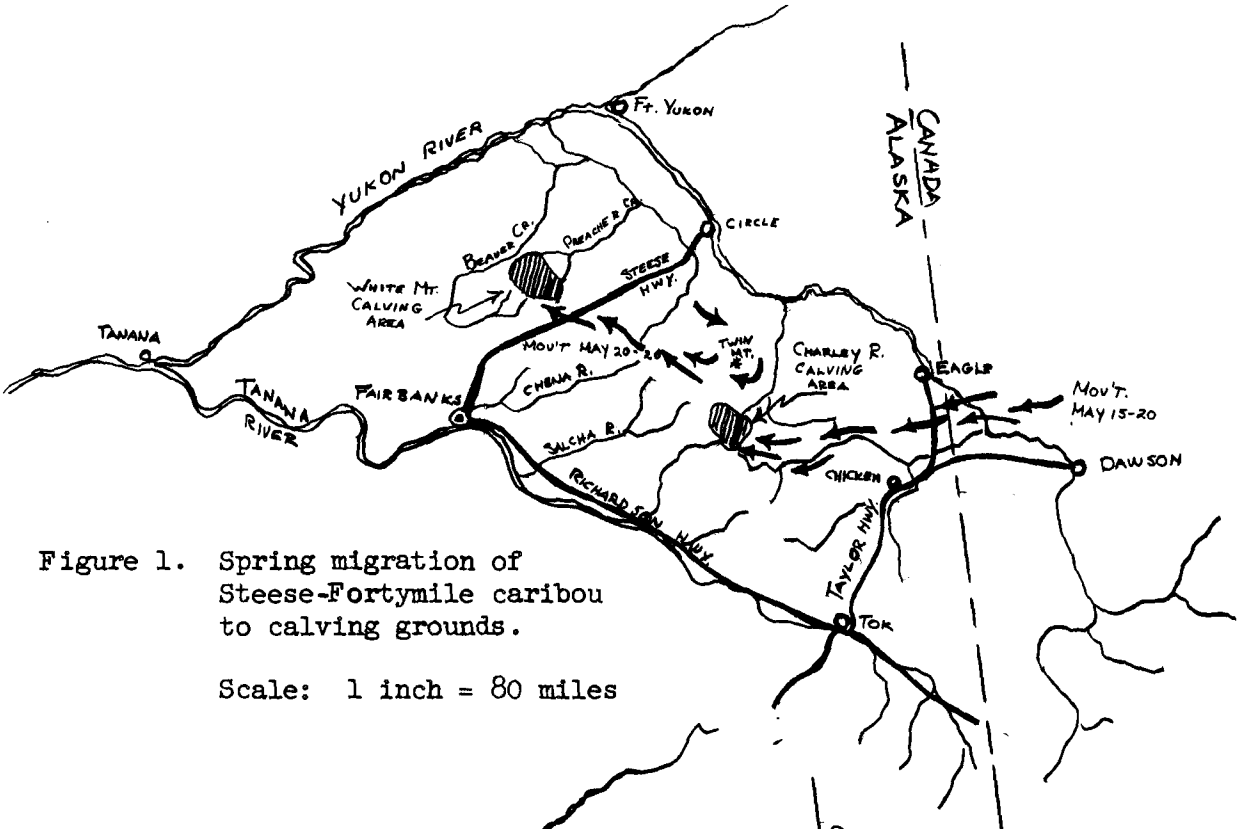


Figure 1. Spring migration of Steese-Fortymile caribou to calving grounds.

Scale: 1 inch = 80 miles

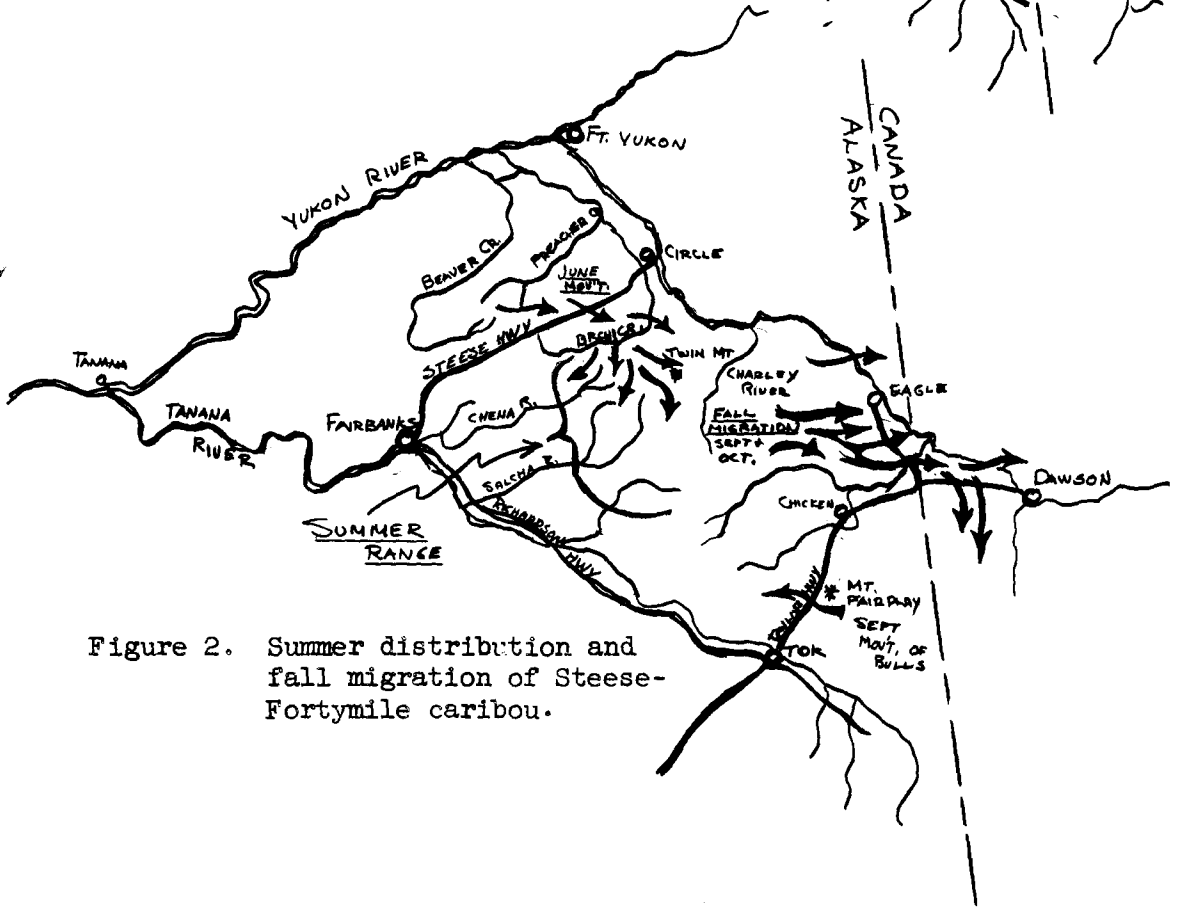


Figure 2. Summer distribution and fall migration of Steese-Fortymile caribou.

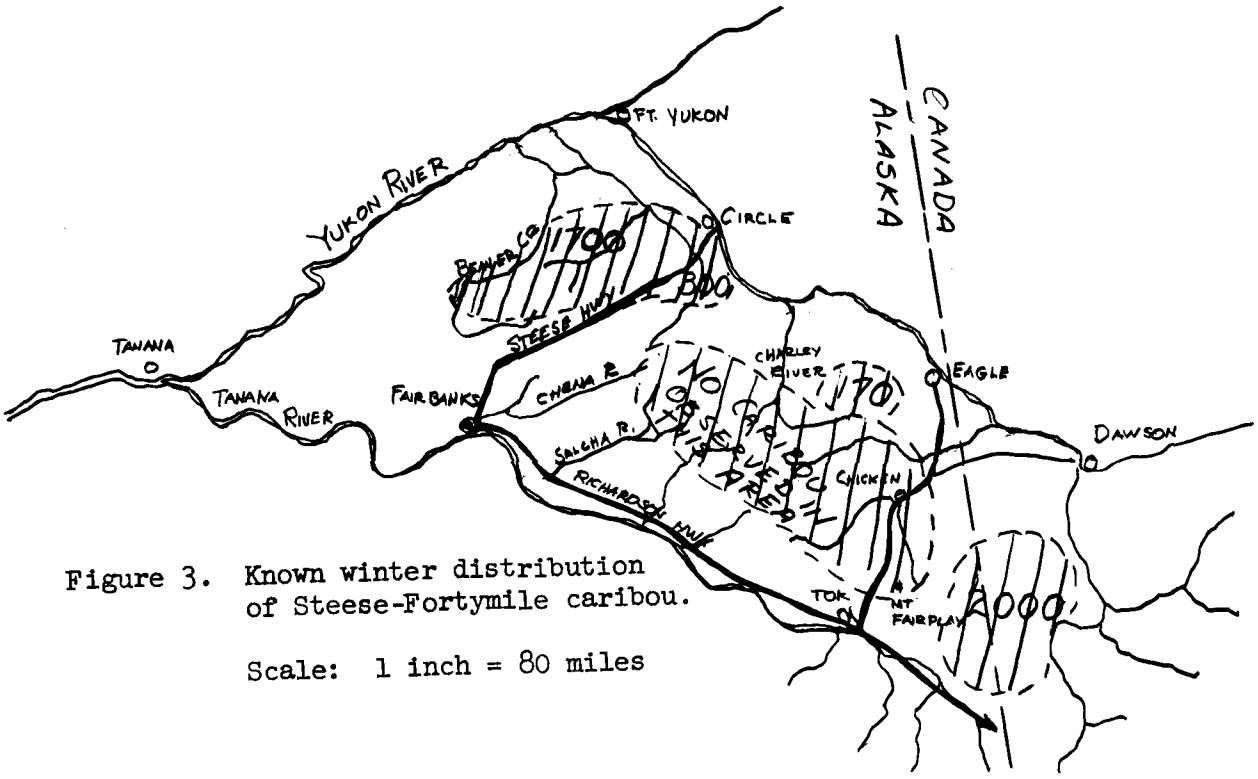


Figure 3. Known winter distribution of Steese-Fortymile caribou.

Scale: 1 inch = 80 miles

JOB NO. 2(c): Movements, Distribution, and Numbers--Arctic Caribou

PERIOD COVERED: January 1, 1957 to December 31, 1957

ABSTRACT

There were relatively few caribou in northwest Alaska until the summer months. By late fall and winter, caribou were spread widely but thinly throughout the Kobuk-Noatak area as well as along the coastal areas.

In the Central Brooks Range and on the Arctic slopes, caribou remained generally north of the range in large numbers until September. By November, several small migrations distributed caribou between Hughes, Kobuk, and Wiseman, however, most of the caribou remained either in the Brooks Range or on the Arctic slopes.

During October, part of the Porcupine herd moved south along the Richardson Mountains east of Old Crow swinging westward across the head of the Black River to the Porcupine River near Settlement. Part of the herd crossed the river and began the winter in the Coleen-Sheenjek area while the larger remaining portion spread out along the Porcupine and segments gradually drifted southeast again toward Canadian wintering grounds.

Both the Delta River and Minchumina herds showed an increase in numbers during 1957. These herds frequented their respective ranges and showed no change in seasonal movements from other years.

OBJECTIVES

To follow movements and ascertain seasonal distribution and relative abundance of Arctic caribou herds as well as other small herds north of the Alaska Range.

TECHNIQUES USED

All information was obtained through interviews and reports with private and commercial pilots flying in the Arctic, reliable local residents, and aerial surveys conducted in conjunction with other Fish and Wildlife activities. The Canadian Wildlife Service and the Royal Canadian Mounted Police at Old Crow supplied information on caribou in the Yukon Territories.

As a matter of convenience, the Arctic caribou range is broken down into three main areas as follows: Northwest Alaska, Central Brooks Range, and Arctic Slope, and Eastern Brooks Range. It is understood that caribou move in and out of each of these areas at various times and no one herd can definitely be identified with a particular area over a period of time.

FINDINGS

Northwestern Alaska: During the winter of 1957 there were no caribou south of the Brooks Range in this area. An occasional small band was encountered on the north drainage of the upper Noatak and Kivalina Rivers. On July 6, Frank Gregory, pilot for Interior Airlines, estimated a herd of 20,000 moving west, behind Cape Lisburne. Henry Childs, Jr., of the University of California, reported the same concentration of caribou at Cape Sabine. He also observed herds varying from 10 to 500 animals moving generally south on 11 occasions during the summer. John Cross, Wien Airline pilot, saw large numbers of caribou moving south at the head of the Kivalina and Noatak Rivers on July 12. By late fall and early winter there were small groups of caribou scattered rather thinly throughout the Kobuk-Noatak drainages. Several thousand moved across the Kobuk Valley into the Warning Mountains in early November according to Cross. Along the coast from Kivalina to Point Hope and inland, caribou were widely spread out in relatively small groups. It is estimated that approximately 10,000 caribou were in this area by December.

Central Brooks Range and Arctic Slope: Few caribou ventured south of the Brooks Range in this area. During January and February, approximately 5,000 were located between the middle fork of the Chandalar and the John Rivers. Ed Badten, Wien pilot, reported about 1,000 between Chandalar Lake and Big Lake and estimated that 5,000 were scattered between the John River and the Chandalar River. Agents King and Orton observed 3 to 4,000 caribou between Wiseman and the north fork of the Koyukuk in March.

Practically all the caribou wintered on the north slopes of the Brooks Range or the "Arctic Prairies". Several pilots observed a large concentration in the vicinity of the Ikpikpuk River and the Price River estimated to number at least 10 to 15,000. Caribou were scattered widely over the Arctic area. No good estimates or counts were obtained, however, it was generally agreed that there were many thousands ranging between Barrow and Umiat by everyone who flew over the area. One observer reported that while flying to all the Dewline sites from Kotzebue to Barter Island, he was seldom out of sight of caribou. Bad weather plagued the annaul caribou survey with Regional Director Rhode; however, it appeared that by late April most of the caribou were west of the Sagavanirktok River. There were no definite migrations reported during the winter or spring until May. Al Wright, Wien pilot, reported that several thousand crossed the Jago River daily between May 6 and 13, moving steadily westward along the foothills.

West of the Colville River, the caribou population remained almost static during the summer. While flying waterfowl transcets on July 7-10, Game Management Agent King and Waterfowl Supervisor Hansen observed large numbers of caribou scattered extensively from Point Lay to Barter Island. Wien pilot James Anderson reported 10,000 caribou along the Canning River at this time. The same concentration was observed, in part, by Director Rhode and Assistant Secretary Ross Leffler during their survey of the Arctic Wildlife Range on July 12.

Caribou began moving south through Anaktuvuk and Chandler during September. Jim Reardon, who was camped at Umiat, observed 5,000 moving south along the Anaktuvuk River on September 18 and 19. On the 24th, a herd of 2,000 came through Umiat moving southwest. These were followed by straggling small groups. On the 28th, an additional 5,000 migrated through all moving southwest.

By November fairly large numbers of caribou had spread out south of the Brooks Range. Olson and Fredericksen located small bands of caribou along the Koyukuk River between Hughes and Wiseman. Caribou also had moved into the Kanuti flats and the lower Alatna River by late November.

The majority of the caribou are believed to have remained in or north of the Brooks Range during the winter months. Pilots and residents of that area all reported caribou present throughout the winter. An estimated 3,000 caribou moving northwest between Chandler River and Umiat seen by William Sheldon between November 10 and 16 is the only movement noted during the early winter.

East Brooks Range: Little is known about caribou movements until late fall and early winter of 1957. The Canadian Wildlife Service reported many caribou wintering along the Porcupine and Peel Rivers, generally below the Arctic Circle. These were also observed, in part, during the spring Arctic caribou survey by the U. S. Fish and Wildlife Service. These caribou moved north in May and June east of Old Crow. Their whereabouts during the summer months was not reported, although a few caribou were known to be ranging over the Old Crow flats. The southward migration occurred during late September and October. Residents of Old Crow, hunting on the upper Porcupine River, reported "caribou by the thousands" coming out of the Richardson Mountains between the Driftwood and Bell Rivers moving in a westerly direction. This herd, generally referred to as the "Porcupine" herd, then moved into the hills at the head of the Black River and Bluefish River.

On October 15, Dr. John Buckley and Game Management Agent Stan Fredericksen encountered a concentration of caribou on the Porcupine River generally between Settlement and Old Rampart. They observed 1,059 animals; however, trails and tracks indicated that many more caribou had been in the area recently. These caribou were being hunted by residents of Fort Yukon by boat and airplane. Mr. Ken Garrison, Manager of Northern Commercial, stated that on October 10 there were hundreds of caribou at Settlement on either side of the river crossing both ways. A week later, he counted approximately 2,000 in the same area. Olson and Fredericksen checked this area on October 21. It was evident that a large herd of caribou had come into this area from the head of the Black River, Squirrel River, and Little Black River. Upon reaching the Porcupine, part of the herd crossed the river and drifted north along the Coleen toward Small Lake and the Sheenjek. The rest of the movement stagnated, and the herd milled around the area between Chalkyitsik Village and the Porcupine. Part of this latter group finally drifted southeast into Canada as far as the head of the Salmon-Trout and Squirrel Rivers during December.

Earl Boese, bush pilot out of Fort Yukon, reported that after reaching the Porcupine several thousand caribou moved through the area between the Coleen River and Sheenjek River to a point 30 miles north of Arctic Village during October. He also stated there were caribou spread generally throughout the area around the lower Sheenjek and Small Lake during December. He spotted approximately 5,000 caribou moving northeast on the Chandalar River northwest of Venetie on November 25. By December 9 they had reached the head of the Christian River. On December 15 several thousand were seen at the headwaters of the Coleen. These caribou were probably those which had passed between the Coleen and the Sheenjek in October plus the herd which had come in from the east fork of the Chandalar and Christian River in early December.

The movements outlined in the following discussion indicate that at least part of the Porcupine caribou wintered in Alaska through December. A part of the herd drifted back into Canada at the head of the Black and Squirrel Rivers, however, many caribou remained. The current distirbution is considerably different than in previous years, since the Porcupine caribou usually winter much further south and east remaining on the Canadian side entirely. Residents of Fort Yukon and Chalkyitsik claim this is the first time in 15 years that caribou have been available in large numbers over a long period of time.

Delta River Caribou Herd: The status of this small herd remains relatively unchanged from year to year. Their numbers are perhaps increased and depleted by periodic interchanges with caribou south of the Alaska Range via Isabella Pass; thus, it is difficult to determine whether or not the herd is increasing or decreasing by virtue of its own level of productivity. At present, the estimated total is 2,500. Olson and Miner counted 1,706 caribou between Portage Creek, Delta River, and Blair Lakes on January 22. Subsequent checks showed approximately 500 additional caribou ranging in small bands west to the Wood River. During the winter months their range may extend 15 to 20 miles out on the Tanana Flats, however, they usually are found in the foothills and mountains between the Delta and Wood Rivers.

Minchumina: This group of caribou winter on the flats south of Lake Minchumina and moved into the area between Wien Lake and Mt. McKinley Park during the summer. Ray Tremblay, Game Management Agent from McGrath, estimated the total herd to number about 2,000. Twenty bands ranging from 2 to 300 individuals and totaling 1,051 caribou were counted by him in April. This is double the estimate for 1956.

RECOMMENDATIONS

That the movement and distribution of Arctic caribou herds and other local herds of north of the Alaska Range should be recorded each year.

Prepared by:

SIGURD T. OLSON
Wildlife Management Biologist

Approved by:

ROBERT F. SCOTT
Supervisor, Game Restoration

DATE: May 15, 1958

JOB NO. 3(a)--Analysis of Productivity--Nelchina Herd

PERIOD COVERED: September 1, 1957, to April 30, 1958

ABSTRACT

The main period of the rut occurred during the first two weeks of October. The mating season progressed successfully judging from the fertility and parturition rates observed later.

Fertility data revealed that about 70 percent of the cows one-year and older were pregnant, and about 82 percent of those two-years and older. Two of nine yearlings checked were pregnant.

Calving progressed similarly to past years, and the peak again fell about May 25. About 80 percent of the cows on the calving grounds dropped calves. It was estimated that about 60 percent of all cows older than yearlings had calves at the end of June. The final calf crop was estimated at 12,500.

Calf survival during the 1957-58 season was good, with about 68 percent of the calves surviving to the yearling stage. About 25 percent of the calves died during the July-November period, but about 90 percent of those living November 1 survived to mid-April. The high survival is attributed to the extremely mild winter and lack of snow.

The increment of yearlings to the herd was estimated at 8,500. The Nelchina herd continues to increase under the effects of high calf crops and calf survival and of low hunters' take.

OBJECTIVES

To obtain quantitative data regarding breeding, fertility rates, parturition, and survival of calves to yearling age.

To determine the factors affecting these elements of productivity, and to interpret the data obtained in terms of management requirements.

TECHNIQUES USED

This project attempts to determine the elements of productivity as reflected by one calf segment of the population during the period from conception, through parturition, to the yearling age-class. Thus

data collected during this twenty-month period would encompass breeding behavior, fertility rates, progression and magnitude of calving, and the survival of calves through their first winter.

A limited amount of ground and aerial observations provided some information on breeding, while the examination of hunters' kills during late fall gave an indication of fertility. Calving and calf survival, however, received the most emphasis during the past "productivity" period.

Daily calf:adult counts from the air traced the progression of calving from mid-May to early June. These counts were made in two of the main calving areas by Predator biologist, Bob Burkholder, and biological aide, Jim Whisenhant, using a 150 hp. Supercub. A final calf:adult count in June provided the data needed for determining the magnitude of the calf crop. During the same period a ground crew consisting of wildlife biologist Ron Skoog and biological aide Willy Miller made composition counts in the same areas, at the same time recording observations on calving behavior and on calf mortality.

Calf survival during the year was determined from aerial counts taken in late fall and in late winter. These counts were compared with the calving data to obtain the increment of yearlings to the herd.

All of the raw data are filed in the Anchorage office of the Federal Aid to Wildlife Restoration Branch.

FINDINGS

Breeding

In late September, 1956, two major concentrations of caribou occurred: one in the Deadman-Nadiwen Lakes region and the other near the Tangle Lakes. Both, from all appearances, contained a full complement of both sexes and all age-classes of animals. By the main period of the rut in early October many of the Tangle Lakes caribou were accessible by foot from the Denali Highway. A heavy hunting pressure at that time, however, prevented the field crew of Skoog and Sloan from obtaining much information concerning breeding; enforcement activities and the gathering of biological specimens utilized most of their time.

Ground contact with a major portion of the herd on October 20 revealed that the main period of the rut was over. Many large bulls had separated from the bands of cows and young stock, and the cows

themselves seemed non-receptive to the young males who were still trying to mount. Some large bulls had shed their antlers already.

All observations indicated that the main period of the rut occurred during the first two weeks of October. This period corresponds to that previously determined for the Steese-Fortymile herd, also. Apparently the 1956 mating season progressed successfully, for both the number of pregnancies observed later in cows taken during the gestation period and the calf crop itself were high.

Fertility

Fertility data were obtained from caribou killed during the period November 1, 1956, to March 31, 1957. These caribou included both hunters' kills and collection specimens. The November-March limitation assured a random sample: cows taken before November being subject to whether or not they yet had had the opportunity to conceive, and those taken after March being subject to the writer's selectivity toward antlerless cows, which normally are not pregnant. Table 1 shows the results of the data obtained, the animals being listed according to their age at the time of conception (approximately October, 1956).

Table 1. Pregnancy, as related to age, of female caribou taken from the Nelchina herd between November 1, 1956, and March 31, 1957.

Age at Conception	No. Cows Examined	No. Cows Pregnant	Percent Pregnant
Calf	5	0	0.0
Yearling	9	2	22.2
2 Years	8	7	87.5
3 Years	3	1	33.3
4-6 Years	8	8	100.0
7-9 Years	7	5	71.4
10 + Years	6	5	83.3
Unknown Adults (2 Yrs. +)	6	5	83.3
Total	52	33	63.4
Cows 1 Yr. +	47	33	70.2
Cows 2 Yrs. +	38	31	81.5

A total of 52 female caribou were examined for pregnancy during the period mentioned, including 5 calves and 9 yearlings. None of the calves were pregnant, but two of the yearlings bore fetuses, indicating that at least some female caribou come in heat during their second fall. No observations on the calving grounds, however, have revealed any animals of this age-class with calves, so apparently few actually become pregnant. The total sample of cows examined shows that about 70 percent of the females one-year or older were pregnant and about 82 percent of those two-years or older.

Another indication of fertility results from a tally in early May of antlered versus antlerless cows. The writer has long thought that adult cows (those two-years or older by the rut) which still bore hard antlers by May 1 were pregnant, whereas those that had shed their antlers were not. In an attempt to prove or disprove this concept he has made a special effort to collect antlerless cows at that time. A total of 27 animals has been examined--12 with hard antlers and 15 without. All of the 12 were pregnant; of the 15 without antlers, 13 were not and 2 were pregnant, although, of the latter, one never had grown antlers and the other probably had shed its antlers in early May, at least two weeks before it was killed (May 24, 1957; still bearing a fetus). Unfortunately some of the two-year-old (23 1/2 months) caribou also retain their hard antlers quite late. A tally on May 10 of bulls of that age (those with the calving groups) showed that 21 percent still had antlers; presumedly a similar proportion of the two-year-old cows also have antlers then. Nevertheless, these data indicate that by the first week of May the great majority of antlered adult cows are pregnant, whereas the antlerless ones are not. Hence, a tally of cows then should give a close approximation of the fertility rate at that time.

Such a count was taken May 7-10, 1957, from caribou moving into the calving area. Of 1,710 cows tallied (yearlings excluded), 1,428 still retained hard antlers, or about 84 percent. Eliminating the antlered two-year-old cows from the 1,428 figure would result in the fertility rate for the animals tallied--somewhat less than 84 percent. Table 1 shows a rate of about 70 percent for a more or less comparable sample (cows one year and older). The difference results probably from the tendency of some non-pregnant cows to remain on the periphery of the calving area. The relatively high number of pregnancies indicated was further substantiated by the actual calf crop.

Calving

The main concentrations of calving caribou remained under surveillance from early May through early June. During that period records were kept of all major movements and composition changes occurring. Daily aerial calf:adult counts traced the rise, peak, and fall of calving activity, while ground observations recorded information on band composition and calf mortality. The combined data, plus other knowledge, provided the means for computing the final calf crop.

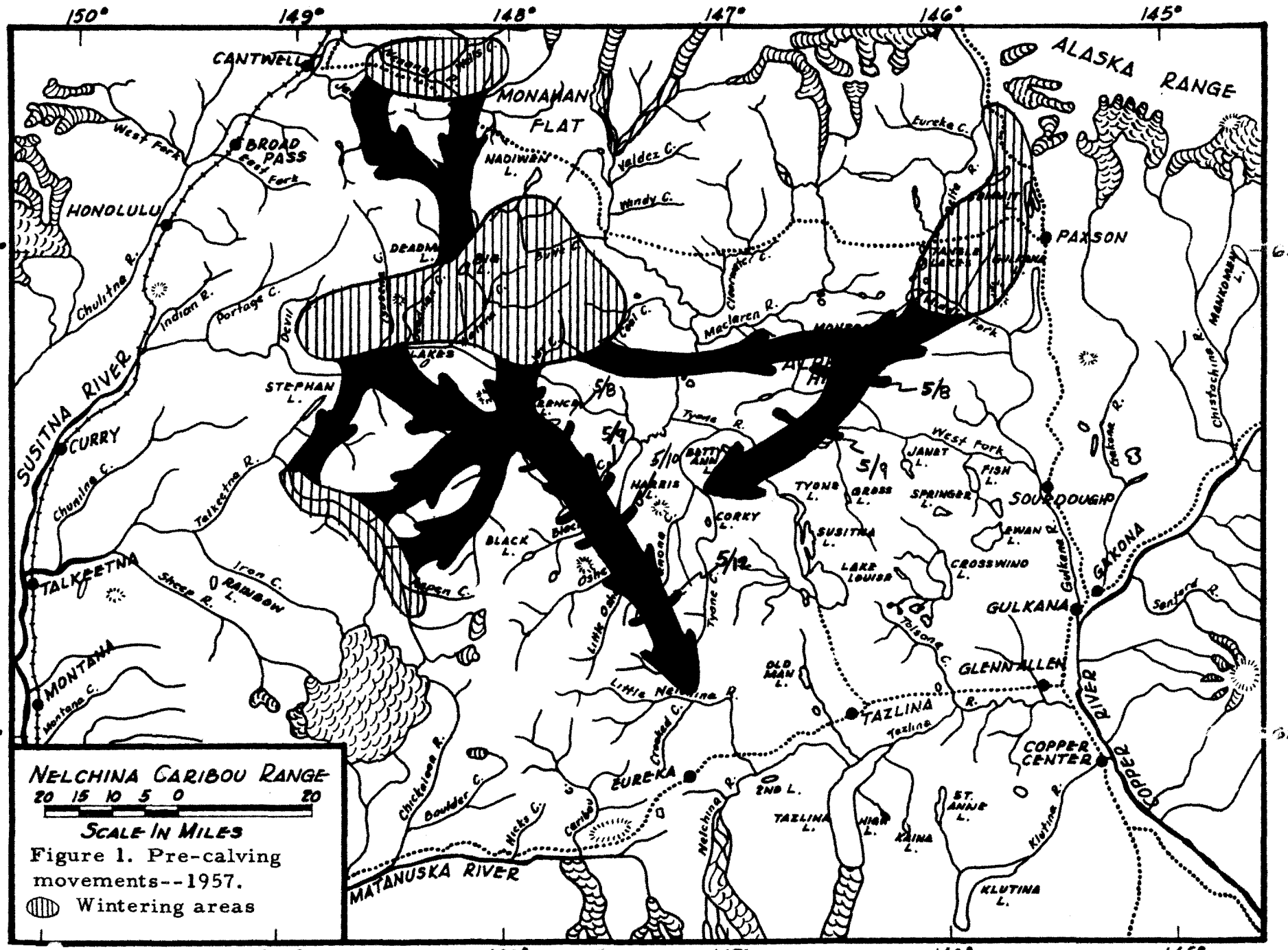
Movements.

Four major wintering areas occurred during the 1956-57 season: Cantwell, Deadman-Nadiwen Lakes, Talkeetna River, and Paxson. In April and early May the calving groups left these areas and proceeded toward the calving grounds, as described in the report on movements--Job 2(a). Figure 1 shows the generalized movement pattern from the wintering areas.

By the first part of May many of the animals had concentrated on Kosina Creek, mostly near the mouths of Tsisi and Gilbert Creeks. These began to move southeastward in long files, reaching Goose Creek by May 9, Black River by May 10, the head of Sanona Creek by May 12, and slightly beyond Tyone Creek by May 14. On the last date caribou were strung out from Kosina Creek to Tyone Creek, and on May 20, to Crooked Creek.

Meanwhile several thousand animals from the Paxson wintering area had reached the Alphabet Hills by May 8. They continued southwestward and had reached Georgia Lake by May 9. Then the movement slowed, but most of the caribou continued to the Oshetna River-Goose Creek area, although some cows actually calved in the timbered areas just west of Tyone River. Figure 1 shows the progression of the movement into the calving areas.

By May 26--the peak of calving as determined in previous years--the caribou had settled into two primary areas: Goose Creek, containing about 5,000 animals, and Tyone Creek, with about 6,000. Other caribou calved in areas between and adjoining these two. A very limited amount of calving also took place along upper Watana Creek and in the Alphabet Hills. Figure 2 shows the distribution of the main calving activity.



NELCHINA CARIBOU RANGE

20 15 10 5 0 20

SCALE IN MILES

Figure 1. Pre-calving movements--1957.

Wintering areas

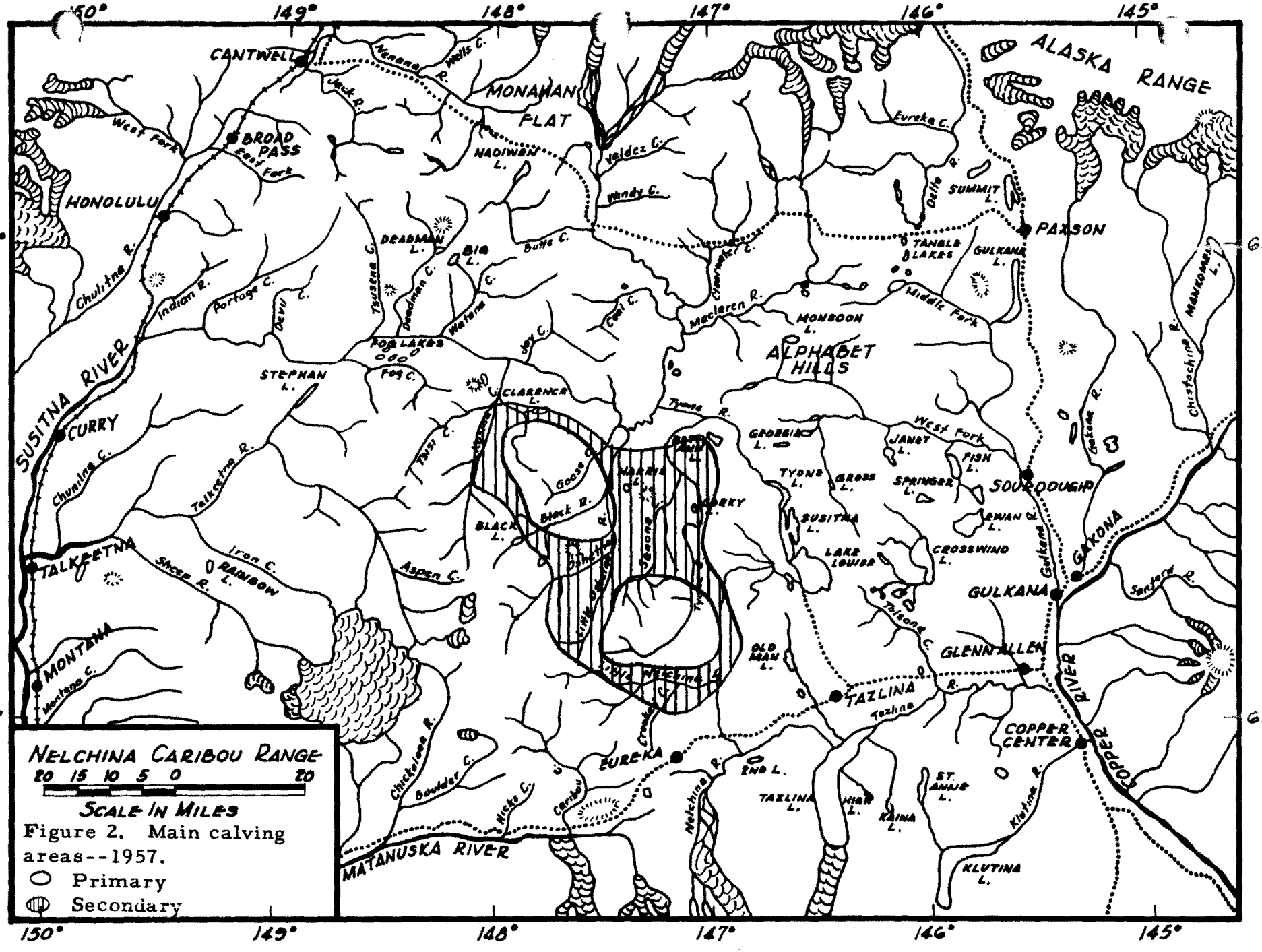


Figure 2. Main calving areas--1957.

○ Primary

◍ Secondary

The post-calving movements began in early June. Animals from the Goose Creek area had assembled in large bands of 200-1,000 animals and were drifting southward. Those from the Tyone Creek area also had banded and were moving westward and southwestward. By mid-June the bulk of the calving groups had concentrated in the area encompassing the heads of Caribou Creek, Little Nelchina River, Oshetna River, and Little Oshetna River. A fair number of bulls had joined the groups by then, and they continued to increase in numbers through June. Figure 3 shows the post-calving movements and the resulting area of concentration in mid-June. Subsequent movements are described in the report on movements--Job 2(a).

Composition of the Calving Groups.

A ground crew operated in the main calving areas throughout May. Composition counts of calving groups were taken during two periods: May 7-10, a period just previous to the start of calving, and May 21-June 1, a period during the peak of calving. The animals tallied during the first were moving southeastward from the Clarence Lake area, and probably included mostly those animals that ultimately calved in the Tyone Creek area. Most of the counts during the second period were taken from animals calving in the area lying just south of Clarence Lake (Goose Creek calving group). Table 2 lists the results of these counts.

The pre-calving counts showed a greater percentage of yearlings and bulls in the groups tallied than did those counts made during the calving period. This difference probably is valid, because both yearlings and bulls continue to detach themselves from the groups as calving progresses. Thus, the May 7-10 counts probably represent the composition of the animals scattered over the entire calving grounds (16 percent yearlings, 79 percent cows, and 5 percent bulls), whereas the May 21-June 1 counts represent the composition of the calving groups in the concentration areas (11 percent yearlings, 87 percent cows, and 2 percent bulls).

Progression of Calving.

To determine the rise, peak, and fall of calving activity, daily calf:adult counts were made from the air. Calves first were sighted on May 14, when two new-born ones were noticed. The tally started on May 16 with counts in both the Tyone Creek and the Goose Creek concentration areas (see Figure 2). Thereafter the Tyone Creek group received the more intensive coverage--a minimum of 1000 adults, plus calves, being tallied there each day through the main period of

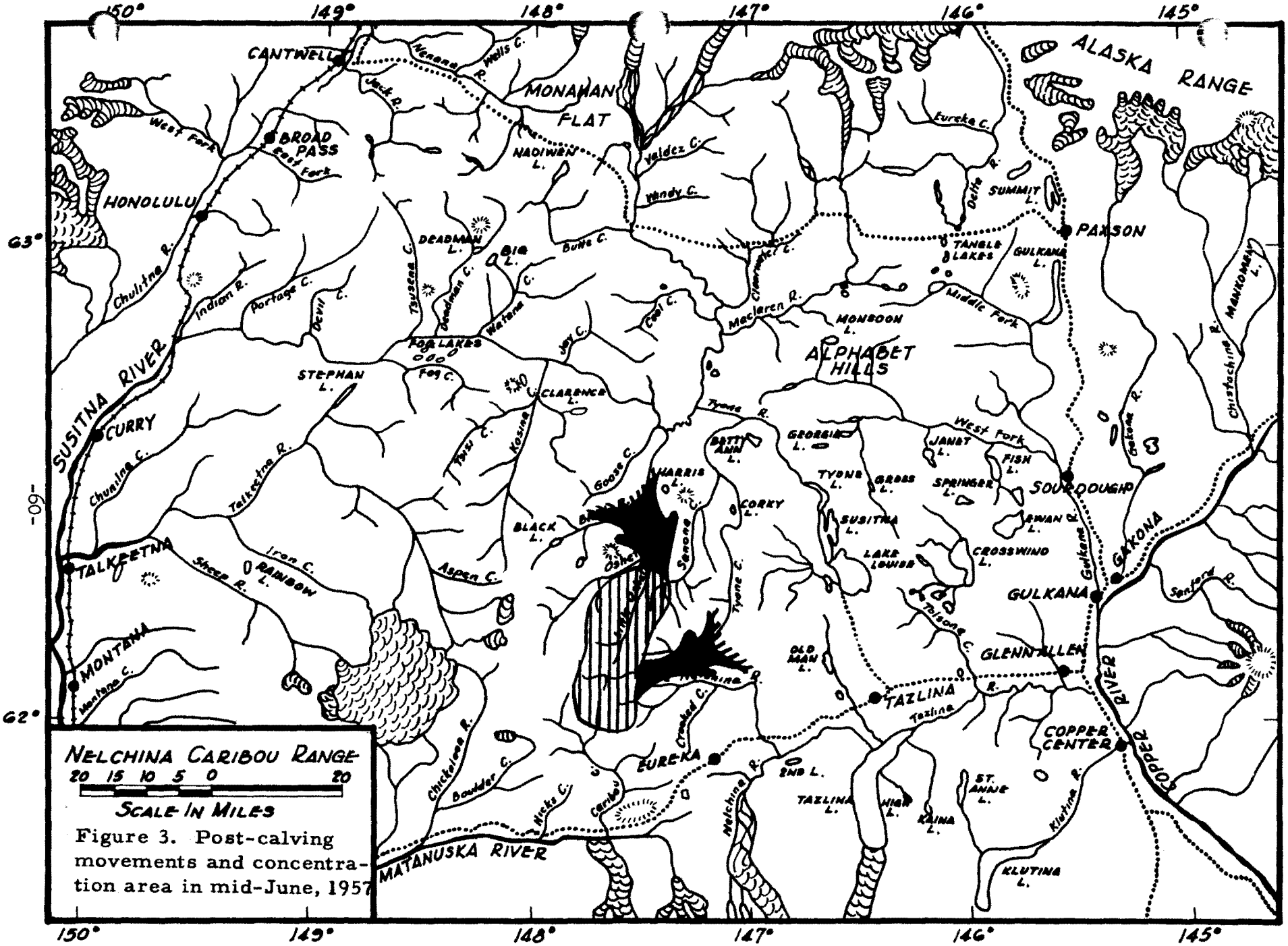


Figure 3. Post-calving movements and concentration area in mid-June, 1957

Table 2. Ground composition-counts taken from calving groups during May, 1957--Nelchina caribou herd.

Date	Calving Group	*Total Animals	Yearlings		Cows		Bulls	
			No.	%	No.	%	No.	%
May 7-10	Entire Segment	2,152	336	15.6	1,710	79.5	106	4.9
May 21-23	Tyone Creek	100	8	8.0	90	90.0	2	2.0
May 24-26	Goose Creek	275	30	10.9	242	88.0	3	1.1
May 27-June 1	Goose Creek	748	90	12.0	647	86.5	11	1.5
Total	All Groups	3,275	464	14.2	2,689	82.1	122	3.7

*Excluding Calves.

calving. In addition, 500 adults, plus calves, were tallied daily during a ten-day period in latter May in the intermediate zone of calving activity lying between the main concentration areas. At the end of May the calf:adult ratios began to fluctuate greatly, probably due to changing band compositions as non-calving animals joined the calving groups, so the daily counts were discontinued. A final tally was made June 6-7 in each of the two main areas. Table 3 shows the results of the calf:adult counts made during May and June.

The calving activities in the Tyone creek area progressed somewhat more rapidly than did that in the intermediate zone--reaching a peak about May 24 as compared with May 25 for the latter. Counts taken in the Goose Creek area at the first and last of the calving period revealed a close similarity to those taken from the Tyone Creek group at those times. Calving in both of these concentration areas probably progressed at about the same rate. Two rates for calving thus were evident--one for that calving segment in the concentration areas and one for that in the intermediate or periphery zones. Table 4 shows the calf:adult ratios, as obtained and adjusted, for the two calving segments of the herd and for the calving segment as a whole. The "adjusted" figures were obtained from an approximate curve derived from plotting the actual calf:adult percentages obtained (see Figure 4). The data for the two segments were averaged directly to obtain the figures expressed for the entire calving portion of the herd. This action seemed valid because each segment contained about half of the calving groups--the concentration areas having about 10,000 animals and the entire calving segment numbering about 20,000. Figure 4 presents a graphical interpretation of the data obtained, illustrating the approximate progression of calving for each of the three portions of the herd. Figure 5 depicts the peak of calving as revealed by plotting the daily calf-increments, derived from the curves in Figure 4. All curves were smoothed by eye--not mathematically. The daily calf:adult ratios taken before May 25 seemed to follow closely a normal distribution. Those taken later varied too much (due to changing band compositions) for an accurate graphical representation. As a result, the writer has assumed a normal distribution and for the latter portion of the curve simply has duplicated the first portion, that lying before the inflection point--May 25 (see Figure 4). Past years' work, however, has shown that actually the curve may be skewed to the right somewhat. Present data are not sufficient to verify this possibility. It is hoped at a future date to combine all the calving data obtained thus far into a mathematical presentation for a more exact analysis.

Table 3. Aerial calf:adult counts made during the 1957 caribou calving season--Nelchina herd.

Date	Tyone Creek			Intermediate Zone			Goose Creek		
	Adults	Calves	%	Adults	Calves	%	Adults	Calves	%
5/16/57	1078	8	0.7	--	--	--	948	3	0.3
5/17/57	1378	5	0.4	--	--	--	--	--	--
5/18/57	1073	21	2.0	--	--	--	--	--	--
5/19/57	--	--	--	--	--	--	--	--	--
5/20/57	1039	54	5.2	--	--	--	--	--	--
5/21/57	1161	115	9.8	--	--	--	--	--	--
5/22/57	998	204	20.4	502	46	9.2	--	--	--
5/23/57	1005	297	29.6	--	--	--	--	--	--
5/24/57	984	402	40.9	561	108	19.2	--	--	--
5/25/57	991	586	59.1	531	195	36.7	--	--	--
5/26/57	1023	656	64.1	521	214	41.1	--	--	--
5/27/57	998	597	59.8	544	269	49.4	--	--	--
5/28/57	1026	632	61.6	511	263	51.5	--	--	--
5/29/57	1006	676	67.2	516	191	37.0	--	--	--
5/30/57	991	645	65.1	528	202	38.3	--	--	--
5/31/57	--	--	--	--	--	--	912	614	67.3
6/1/57	--	--	--	--	--	--	--	--	--
6/2/57	--	--	--	--	--	--	--	--	--
6/3/57	--	--	--	--	--	--	--	--	--
6/4/57	--	--	--	--	--	--	--	--	--
6/5/57	--	--	--	--	--	--	--	--	--
6/6/57	--	--	--	--	--	--	1614	1016	62.9
6/7/57	1579	900	57.0	--	--	--	--	--	--

Table 4. Calf:adult percentages for all segments of the calving portion of the Nelchina caribou herd, as obtained in 1957 from actual counts and as adjusted from an approximate graphical representation of those counts (see Figure 4).

	Concentration Areas			- Intermediate Zones			Entire Calving Segment	
	Calf:Adult %		*Calf	Calf:Adult %		*Calf	Calf:Adult %	*Calf
Date	Actual	Adjusted	Increment	Actual	Adjusted	Increment	Adjusted	Increment
5/14/57	--	0.1	--	--	--	--	0.1	--
5/15/57	--	0.2	1	--	0.2	--	0.2	1
5/16/57	0.5	0.4	2	--	0.3	1	0.4	2
5/17/57	0.4	0.8	4	--	0.5	2	0.7	3
5/18/57	2.0	1.7	9	--	0.9	4	1.3	6
5/19/57	--	2.9	12	--	1.8	9	2.4	11
5/20/57	5.2	5.0	21	--	3.0	12	4.0	16
5/21/57	9.8	9.9	49	--	4.5	15	7.2	32
5/22/57	20.4	17.5	76	9.2	6.5	20	12.0	48
5/23/57	29.6	28.5	110	--	12.0	55	20.3	83
5/24/57	40.9	41.0	125	19.2	22.0	100	31.5	112
5/25/57	59.1	52.0	110	36.7	34.0	120	43.0	115
5/26/57	64.1	59.6	76	41.1	44.0	100	51.8	88
5/27/57	59.8	64.5	49	49.4	49.5	55	57.0	52
5/28/57	61.6	66.6	21	51.5	51.5	20	59.1	21
5/29/57	67.2	67.8	12	37.0	53.0	15	60.4	13
5/30/57	65.1	68.7	9	38.3	54.2	12	61.5	11
5/31/57	67.3	69.1	4	--	55.1	9	62.1	6
6/1/57	--	69.3	2	--	55.5	4	62.4	3
6/2/57	--	69.4	1	--	55.7	2	62.6	2

*No. of Calves/1000 Adults

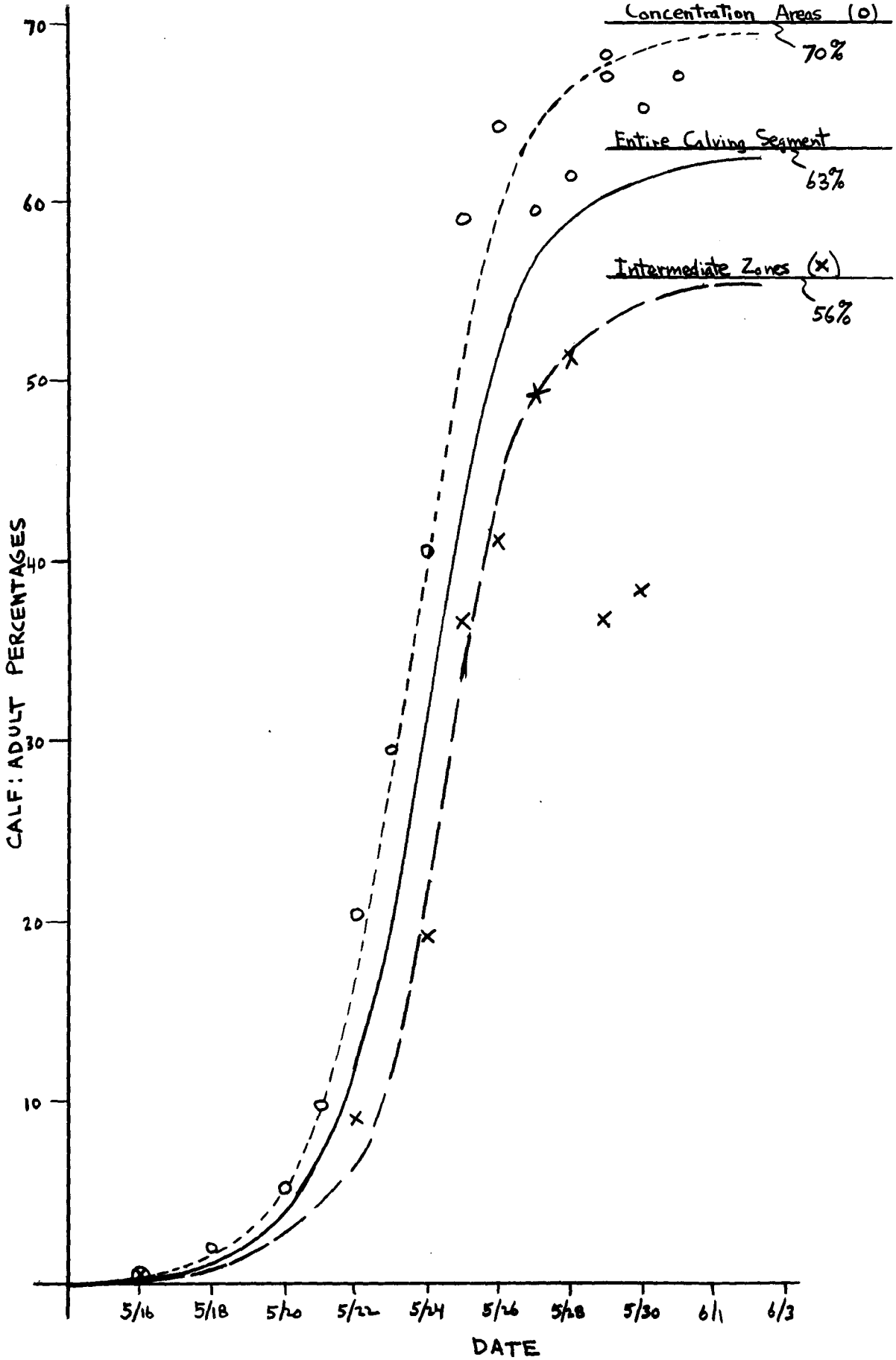


FIGURE 4. Graphical representation of calf:adult percentages obtained from aerial counts, 1957--the curves being approximations.

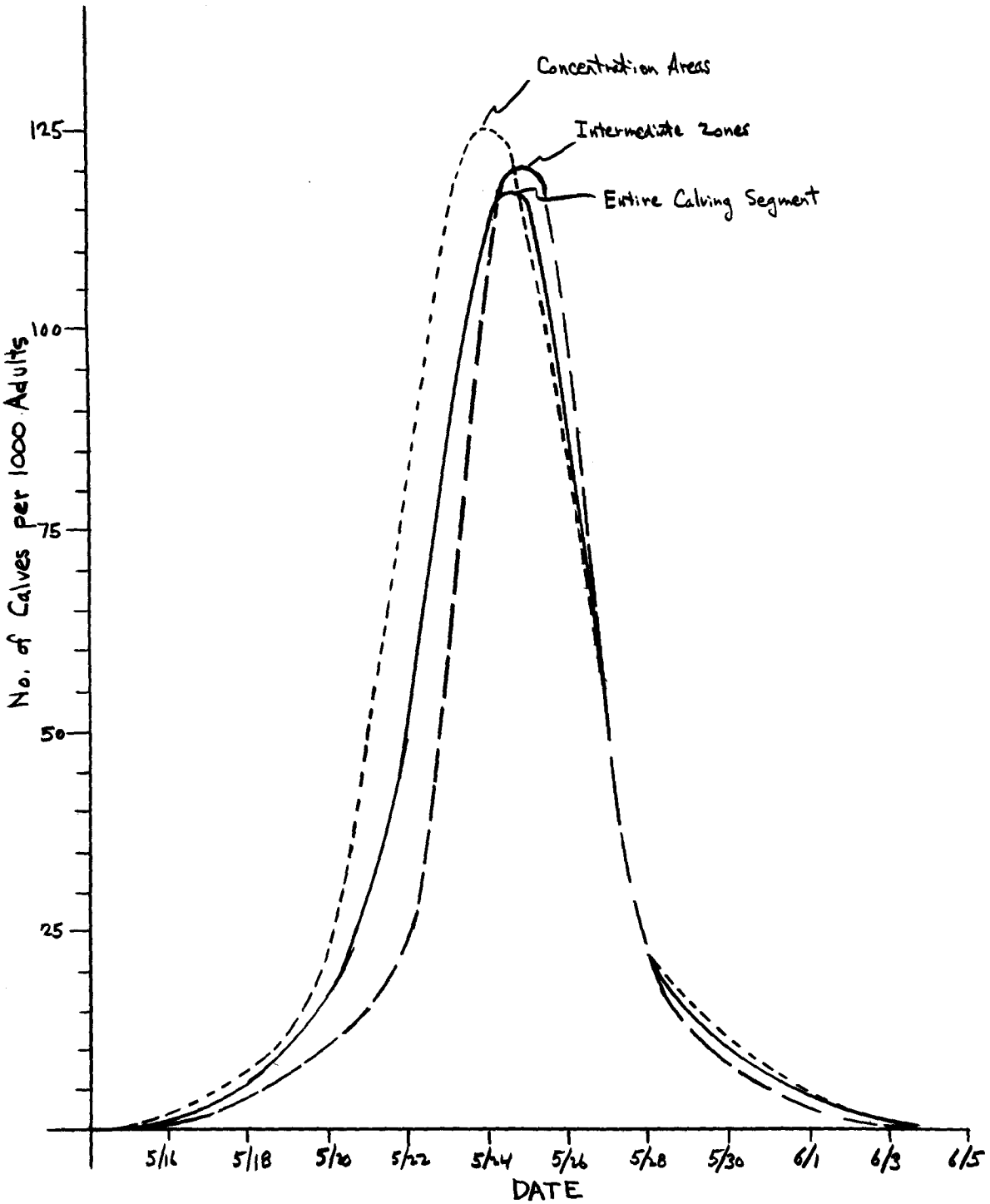


FIGURE 5. Progression of caribou calving in 1957, as depicted by plotting daily calf increments.

The curves shown in Figures 4 and 5, however, do give an approximation of the progression of calving during 1957. The data compared closely with that obtained in past years, and again the peak fell about May 25. The upper asymptotes indicated for each curve proved to be 70 percent (calf:adult ratio) for the concentration areas, 56 percent for the intermediate zones, and 63 percent for the entire calving segment--the difference being due to a greater or lesser number of yearlings and bulls. The first and the last figures are verified in part by comparison with the ground composition counts. Those counts (see Table 2) showed that for the concentration areas about 87 percent of the adults were cows and for the entire calving segment, about 79 percent. Thus the calf:cow ratio for both groups was about 80 percent (70:87 and 63:79, respectively)--meaning that about 80 percent of the cows (excluding yearlings) in the calving segment of the herd had calved. This figure compares closely with the antlered-cow tally mentioned earlier, taken before calving, in which 87 percent of the cows were still bearing hard antlers in early May. Eliminating the few antlered two-year old cows, normally not pregnant, would bring the figure closer to 80.

Calf Crop.

Calf:adult counts taken June 6-7 on 5,109 animals revealed a ratio of 60 percent (see Table 3). Those animals probably represented a portion of the entire calving segment, which contained 79 percent cows, so the calf:cow ratio was about 76 percent (60:79) at that time. Some calves were yet to be born, however, and others yet to die; in addition, some non-calving cows were present in areas outside the main calving grounds. Thus, by the end of June the calf:cow ratio for the entire herd would be much less than the 76 percent figure above. Last year's work indicated a final calf:cow ratio of 60 percent (all cows older than yearlings). Lacking further data, the writer assumes that the 1957 ratio closely approaches this figure, because all other data on calf production for the two years are quite similar.

Limited composition counts in the past have revealed that about 47 percent of the herd is composed of cows older than yearlings, or 21,000 in a herd of 45,000 animals. Thus, the final calf-crop in 1957 at the end of June totaled about 12,500 calves (60 percent of 21,000).

Calf Survival

Calf:adult counts were continued throughout the year to ascertain calf survival. The first counts after the end of calving in June were taken October 23-29, 1957. Of a total of 2,919 animals tallied, 596

were calves. At that time most of the bands examined still seemed to contain a full complement of bulls, as is normal during the rut in early October, although a few of the old bulls had detached themselves from the groups. Limited herd composition data indicate that about 43 percent of the adults are males. Thus, the composition of the 2,919 animals tallied probably was as follows: 596 calves, 1,324 cows, and 999 bulls. The calf:cow ratio at the end of October then was about 45 percent (596:1,324). Calf mortality since about July 1, when the calf:cow ratio was 60 percent, therefore approximated 25 percent (15:60).

The next calf counts were taken during late winter, April 16-19, 1958. By then calving groups had started to drift toward the calving grounds and adult bulls were noticeably few. Also, several small bands of calves were noted, indicating that some already had left their mothers. Of 1,872 animals tallied, 523 were calves. From all appearances the composition of the adults probably was quite similar to that obtained May 7-10, 1957, from animals moving into the calving grounds (see Table 2). Those adults (older than yearlings) consisted of 94 percent cows. Applying that information to the mid-April counts above classifies the 1,872 animals tallied as follows: 523 calves, 1,268 cows, and 81 bulls. Thus, the calf:cow ratio in mid-April, 1958, after almost one year, was slightly over 41 percent. That reveals a calf mortality of about 9 percent since November 1, 1957 (4:45). Table 5 shows the calf mortality during 1957-58 as estimated from the above counts.

Table 5. Calf survival during 1957-58 as revealed by calf counts taken during the year.

Date	Calf:Cow Ratio	% Calf Mortality	% Calves Surviving
July 1, 1957	.60	25	--
November 1, 1957	.45	9	75
April 15, 1958	.41		68

The calf counts indicated a good survival of the 1957 calf crop to the yearling stage. Apparently most of the mortality occurred during the July-November period, although the data used may have distorted the true picture. The apparent low mortality during the November-April period was expected due to the extremely mild winter, for

snowfall was light, and at no time did the depth exceed 15 inches, except for drifts. In many places the wind exposed the ground; caribou were able to obtain food readily. Eighteen animals collected during the winter all were in excellent condition, with much viscera fat--even the pregnant cows. About 68 percent of the final calf crop in 1957 survived to the yearling age-class.

Herd Increment

By the end of June, 1957, the writer estimated that about 12,500 calves had been added to the herd. Sixty-eight percent of these survived to mid-April, 1958, and thus the Nelchina caribou received an increment of about 8,500 animals in the form of yearlings. With the hunters' kill continuing to remain under 4,000 animals, with good calf crops, and with good calf survival, the Nelchina caribou herd can do nothing but increase. Where will it all end?

RECOMMENDATIONS

Information on both the breeding behavior and biology of caribou remains inadequate. An attempt should be made to close this gap in our knowledge.

More data concerning fertility rates would serve to round out that phase of the productivity study. A larger collection of ovaries could supply much of the presently lacking information.

Enough data probably has been gathered now on the progression of calving, at least enough to adequately describe this phenomenon, that a detailed study is no longer necessary each year. The calf crop itself, however, must be determined each year, and that can be done in a number of ways: 1) a tally of antlered cows moving into the calving area can provide data on the approximate number of cows that are pregnant, 2) an aerial count at the end of May or early June will show the relative success of calving; and 3) a count in mid-June of cows with and without udders versus those with and without calves will reveal both initial and final calf crop.

Calf survival through the year is an important phase of productivity that must be determined each year. The present procedure of aerial calf:adult counts seems adequate.

Prepared by:

Ronald O. Skoog
Wildlife Management Biologist

Approved by:

Robert F. Scott
Supervisor of Game Restoration

Date: April 30, 1958

JOB NO. 3(b): Analysis of Productivity--Steese-Fortymile Herd

PERIOD COVERED: May 1, 1957 to April 30, 1958

ABSTRACT

Productivity and survival studies during 1957 and 1958 provided the following information:

1. Calving occurred in two widely separated areas. The largest calving concentration was located on the Charley River. The second calving area was located in the White Mountains north of the Steese Highway.

2. Calving activities began about May 24 or 25, rose to a peak on May 28 or 29, and were practically over by June 6.

3. Limited data indicate the initial calf:cow ratio was 70:100.

4. The calf:cow ratio obtained during the highway crossing (June 7-18) was 38:100, indicating an early mortality of 46 percent.

5. A count of cows with distended udders without calves yielded an early calf mortality index of 24 percent. The actual figure probably lies somewhere between 24 and 46 percent.

6. The yearling:cow ratio was only 3:100 indicating a low calf survival rate for the preceeding year. Calf:adult ratios obtained during the preceeding winter substantiate the low yearling:cow ratio above.

7. Calf:adult ratios obtained during the winter of 1957 and 1958 are similar to those obtained the previous year. If these are characteristic for the entire herd, a decrease in total numbers is inevitable in the near future.

8. At Eagle Summit, 7300 caribou (including calves) were counted crossing the Steese Highway.

9. Composition counts on 4328 individuals crossing June 7-13 indicate that 26 percent were calves, 3 percent yearlings, 70 percent cows, and 1 percent bulls.

OBJECTIVES

1. To obtain quantitative data regarding breeding, fertility rates, parturition, and survival of calves to yearling age.

2. To determine the factors affecting these elements of productivity and interpret the data obtained in terms of management requirements.

TECHNIQUES USED

Both aerial and ground surveys were utilized to accomplish the objectives. Glen Orton, James King, Stan Fredericksen, Enforcement Agents, and Joe Miner, Mammal Control Supervisor, all served as pilots during various phases of the aerial survey work. Sig Olson, P-R Biologist, acted as observer for the aerial surveys, supervised and assisted the ground surveys conducted by Biologists Aids Jack Gross and Sam Harbo.

Preliminary aerial reconnaissance served to track the movement of the calving segment of the herd from the wintering grounds to the calving grounds. Thereafter, detailed aerial calf counts were planned to determine the pattern of calving and the initial calf crop. A combination of circumstances, however, seriously hampered this phase of the work. Initially, due to variations in distribution and movements prior to calving, the calving areas were not located until calving was well underway. Subsequently, a combination of poor flying conditions and an untimely airplane crash permitted only three days of survey work to be accomplished before the caribou left the calving areas. Ground surveys were also more limited than originally planned. The ground crew was detalied to other studies until the calving areas were determined. Although the migration to the calving grounds was missed and the calving ground studies did not materialize, the migration from the calving grounds in the White Mountains was intercepted and the desired data on productivity, calf survival, and numbers obtained. Age ratios obtained from aerial and ground counts during the remainder of the year provided a basis for determining survival of calves to the yearling stage.

FINDINGS

Movements and Distribution: The characteristics of the spring migration to the calving areas are fully discussed in "Spring" section in Job. No. 2(b).

Numbers: Post-calving highway counts at Eagle Summit indicated that approximately 5000 adult caribou had crossed the Steese Highway to the calving grounds in the White Mountains. This is the smallest calving group noted in this area since 1954. In 1954 there were approximately 17,000; in 1955, 9700; in 1956, 20,700. How many caribou constituted the calving groups south of the highway is unknown. It is believed, however, there were considerably more than north of the Steese. The reasons for the variation in use of the White Mountains

calving grounds are not known. Timing of the migration, coupled with the long distances involved in the route of travel, may have been responsible, since a large part of the herd calved before reaching the White Mountains. In 1954, 1955, and 1956 the movements across the highway took place generally between the 1st and 20th of May. In 1957, there was no sign of any migration into the area as late as May 18, thus, it was presumed the calving would occur elsewhere.

When it was discovered that two calving areas existed it was decided that the principal effort would be directed toward the White Mountain area, since it was possible to obtain data during calving and later when the calving groups migrated across Eagle Summit.

Prior to calving, the migrating caribou move in groups ranging from 15-20 to several hundred animals. Once on the calving grounds, however, these groups break up and spread out.

During the calving period May 26 to June 4, counts made on 155 groups of adult caribou totaling 6757 animals averaged 11 adults per group. The size of the bands ranged from 2 to 68 individuals. After calving, the caribou regroup into traveling herds again. On June 5 they averaged 59 individuals per group and herds ranged in size from 4 to 300 animals. By June 15 the average group size had increased to 94 with individual groups as large as 447.

Calf:Adult Counts: Aerial calf:adult counts in the White Mountains were made on May 27 and 28 and June 4. After May 28 weather conditions prohibited further counts until June 4. On the latter date, an airplane crash occurred during the survey which prevented further counts. It was evident, however, that calving was over as of this date and a definite migration out of the calving area was underway. Because of the relatively few caribou in the area, the counts obtained were small as compared to previous years. Only 75 adult caribou were sighted per hour as compared to 285 per hour in 1956.

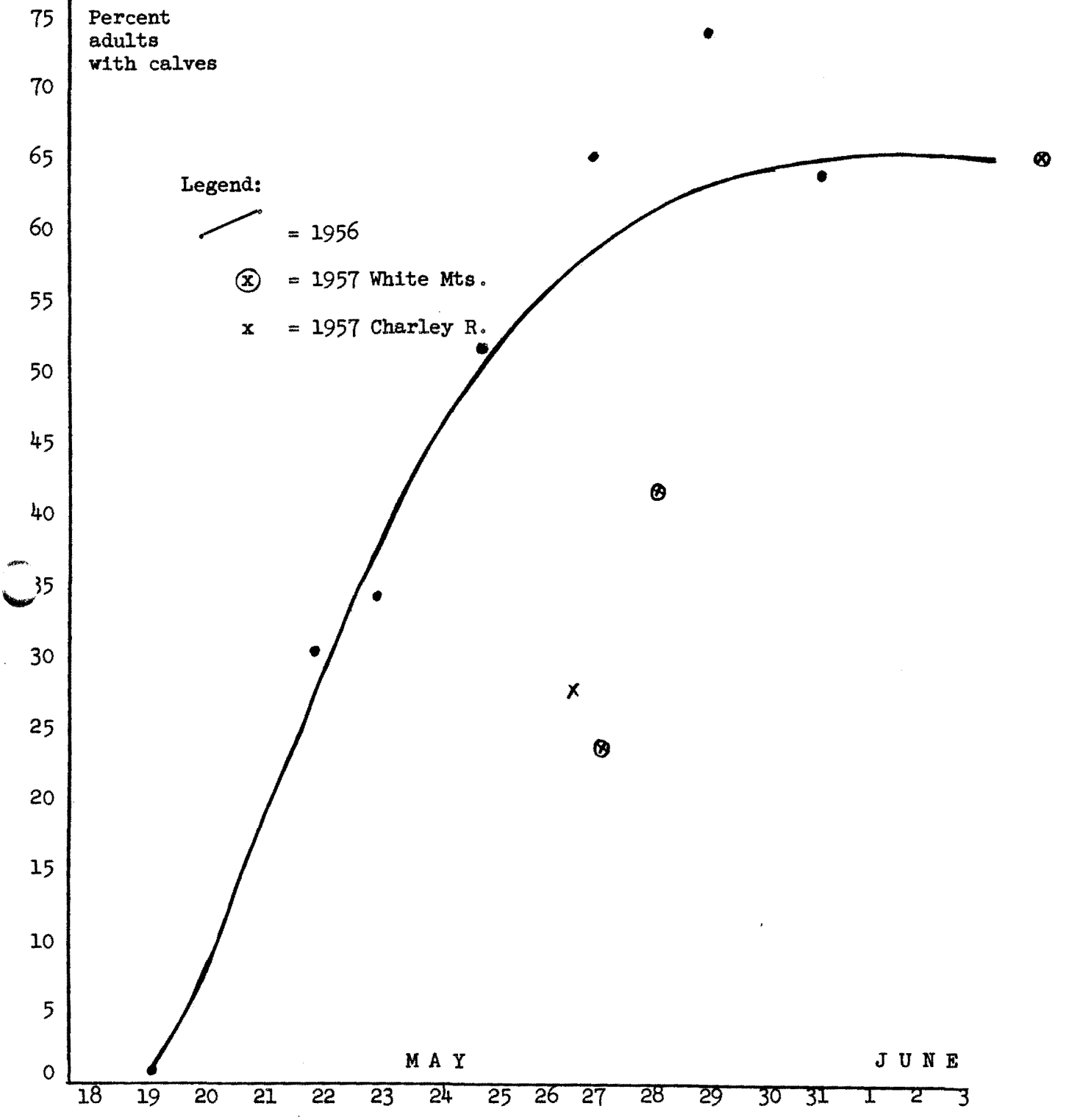
Despite this fact the counts obtained represent an adequate sample. Approximately 5000 adults utilized this area for calving. Five hundred forty-three adult caribou were counted on May 27 and 28 for an average of 271 per day. This amounts to a 5 percent sample each day.

Aerial calf:adult counts are presented in Table 1. As in previous years, "fringe" and "center" areas were again noted. The fringe groups were comprised of bands of cows and yearlings still moving twoards or just into the calving grounds located at the head of Champion, Quarts, and Bear Creeks. The "center" groups were stationary and calving was in progress. Due to the circumstances, the differences between the fringe and center areas were quite obvious as indicated by the counts in Table 1.

Table 1. Aerial Calf:adult counts - Steese-Fortymile caribou 1957 calving season.

	Date	Adult	Calf	% Adults w/calves	Remarks
FRINGE GROUPS	White Mts. (Head of Champion, Bear, and Quartz Creeks)				
	5/27	53	1	1%	Yearlings and cows moving into calving area
	5/28	36	0	0%	
	TOTAL	89	1	1%	
CENTER GROUPS					
	5/27	185	45	24%	Stationary groups.
	5/28	269	112	42%	
	6/4	67	44	66%	
	TOTAL	521	201		
FRINGE GROUP	Charley River (South and west forks)				
	5/26	104	0	0%	Moving toward Steese
	5/27	82	0	0%	Moving toward Steese on Birch Creek
CENTER GROUP					
	5/26	227	64	28%	Stationary

Figure 2. Progress of calving---Steese-Fortymile herd 1956 and 1957. (Points represent actual counts - curve by inspection.)



Progression of Calving: The date of earliest calving was not observed. Calving was already in progress on the Charley River and the White Mountains when the groups were discovered on May 26 and 27 respectively. It is probable that calving began one or two days earlier on the Charley River as evidenced by the higher percentage of adults with calves (28 percent) as compared to 24 percent for the White Mountain area on May 29. Table 1.

The progress of calving in the White Mountains, except for being perhaps four to five days late, appeared quite similar to 1956. Figure 1 compares the progression of calving for 1956 and 1957. Although the 1957 data are represented by only three days counts, it is quite apparent that the same pattern exists for both years.

INITIAL PRODUCTION

Initial production was assessed in two ways: The percentage of antlered versus anterless cows in the groups enroute to the calving grounds and the final calf:adult ratio obtained by aerial counts on the calving grounds. The data for both methods are limited but serve to substantiate one another.

To date no concrete or tangible relationship has been shown which proves that antlered cows will produce calves and antlerless cows will not. Nevertheless, the percentage of antlered cows in pre-calving groups enroute to the calving grounds has closely approximated the calf:cow ratios obtained from both aerial and ground counts on the calving grounds since 1954. As a matter of record, therefore, this information has been included as an index to productivity for the current year. Prior to calving, tallies on antlered varsus antlerless cows were obtained on 100 individuals in the vicinity of Twelvemile Summit. These counts are presented together with similar counts for the previous three years in Table 2.

Table 2. Relationship of antlered cows on the calving grounds to initial calf production.

Calving Ground Tallies	1954	1955	1956	1957
Total cows	1066	282	590	100
Cows w/antlers	766	200	439	71
% Cows w/antlers	73.8	70.9	74.4	71.0
Initial calf:cow ratio	74.9	72.0	75.0	(1)

(1) Initial ratio not obtained - aerial calf:adult count on calving grounds June 4, 1957, 66:100 (Total count on 67 adult caribou).

The data suggests that the initial calf:cow ratio would be in the vicinity of 70 percent if the percentage of antlered cows is used as an index.

Post-calving composition counts at Eagle Summit showed that 95 percent of 1382 adults tallied were cows; 4 percent were yearlings; and 1 percent were bulls. Assuming that the composition of the adult segment of the herd did not change materially while on the calving grounds and, by substituting the percentage of cows for adults, the calf:adult ratio of 66:100 obtained on June 4 can be converted to a calf:cow ratio of 69:100. This tends to support the supposition that the initial calf:cow ratio was about 70:100. The pattern of calving and initial calf production thus seems to be quite similar to 1956. If it is accepted that initial productivity was in the neighborhood of 70 calves per 100 cows, it is self-evident that the fertility of the Steese-Fortymile herd continues to be satisfactory. The lack of calves shown by subsequent calf:adult counts during the ensuing year indicates a problem of calf survival rather than a lack of productivity.

HIGHWAY CROSSING

The best information on the final calf crop, early mortality, and total numbers was obtained when the caribou moved out of the White Mountains across Eagle Summit toward their summer range.

A three-man crew, stationed at 106 mile (Eagle Summit) June 7 to 15, collected the following data:

1. Number of calves plus total adults.

2. Composition counts wherever complete counts on bands could be obtained.

3. Total counts of all animals crossing.

4. Calf mortality.

Supplementary counts during the period June 15 to 19 were provided by Wilbur Libby who was conducting an ecological study in the Eagle Summit area at that time.

The weather June 7 to 19 was very favorable for calf survival and census work. Light intermittant rain fell on June 21, otherwise, the weather was clear and warm. No snow storms occurred during the crossing and only small patches of snow were present on the north facing slopes.

On June 5 an aerial check over the calving grounds and the area between Champion Creek and Eagle Summit showed approximately 2000 caribou moving slowly toward Eagle Summit. It appeared to include most of the calving segment of the herd north of the Steese Highway. The first groups crossed on June 7. Caribou did not cross again until June 10. The crossing reached its peak on June 12 and had almost subsided by June 14. On June 18 and 19, the last bands crossed and the migration from the calving ground was over.

Total Numbers: Approximately 7300 caribou, including calves, crossed the highway at Eagle Summit between June 7 and 19. All caribou were counted through June 13. There is a possibility that a few could have crossed undetected between June 14 and 19, however, none were recorded during that period. Several groups were seen north of the highway by Libby's survey crew but it appears that they banded together and crossed as two large herds of 1500 and 300 adults (plus calves) on June 18 and 19 respectively. It was not possible, according to Libby, to obtain detailed composition counts or even accurate total counts, since the herds were moving rapidly in compact groups when crossing the road. He estimated that the calf:adult ratio for these groups was at least 50:100. It may have been even greater in the group of 300 seen on the 19th, since the first 30 cows had 30 calves and the last 20 cows had 16 calves. A summary of the daily total counts is presented in Table 3.

Thirty-nine groups of caribou were counted across the highway ranging in size from 2 to 447 individuals. The average number of animals per group was 94. Sixty-two percent of the groups consisted of 100 or less. The distribution according to group size is presented in Table 4.

HERD COMPOSITION

Calves comprised 26 percent of the total number of caribou counted between June 7-13. The calf:adult ratio for this period was 36:100. Had it been possible to obtain comparable data on the groups crossing June 18 and 19, these ratios may have been slightly higher. It is doubtful, however, they would have been comparable to 1956 when 32 percent of the total were calves and the calf:adult ratio was 47:100.

NOTE: An important point should be kept in mind concerning the current data as compared to previous years. The 1956 data only represents that segment of the herd which calves in the White Mts. It is very probable that a considerably larger group calved south of the highway and there is no information available concerning the latter.

Table 3. Summary of daily total counts of caribou crossing Eagle Summit June 7-19, 1957

DATE	ACTUAL COUNTS Total	Calf	Adult	ESTIMATED (Less calves)	GRAND TOTAL
6/7	143	28	115		
6/8-9	0	0	0		
6/10	250	35	215		
6/11	184	35	149		
6/12	2855	740	2115		
6/13	1099	357	742	50(1)	
6/14-17	0	0	0		
6/18	0	0	0	1500(2)	
6/19	0	0	0	300(3)	
TOTAL	4528	1194	3334	1850	6378 + 918(1)(2)(3) = 7296

6/7-13 Calves = 26%
Calf:adult ratio = 36:100

(1) No. calves calculated using calf:adult ratio 36:100 = 18 calves

(2) Libby est. calf:adult ratio 50:100 = 750 calves

(3) Libby noted first 30 adults in group had 30 calves and last 20 had 16 calves. Assumed therefore calf:adult ratio at least 50:100 = 150 calves

918

Table 4. Size of caribou herds crossing the Steese Highway at Eagle Summit June 7-19, 1957

GROUP SIZE	NUMBER GROUPS	PERCENT OF TOTAL
0 - 25	16	
26 - 50	4	62
51 - 75	1	
76 - 100	3	
101 - 125	1	
126 - 150	2	10
151 - 175	0	
176 - 200	1	
201 - 225	0	
226 - 250	2	13
251 - 275	2	
276 - 300	1	
301 - 325	0	
326 - 350	2	13
351 - 375	2	
376 - 400	1	
401 - 425	0	2
426 - 450	1	
TOTAL	39	

Detailed composition counts obtained on 1382 caribou June 10-13 are presented in Table 5. The calf:cow ratio increased from 17 to 67:100 during this time. The groups the least encumbered with calves comprise the forward ranks. The center and rear of the movement contain increasingly larger proportions of calves. They do not necessairly reflect the actual composition of the group as a whole however. The proportion of yearlings increased from 4 to 7:100 adults June 10 and 11 and dropped down to 3:100 on the 12th. No yearlings were counted that day. Yearlings comprised 4 percent of the total adults counted across the highway.

The lack of yearlings in comparison to previous years is very evident and reflects the low calf survival rate indicated by calf: adult counts the preceeding fall and winter. (Job Completion Report, Proj. W-3-R11, Alaska, June 30, 1957. Caribou Management Investigations, Job No. 4(b), p-112.) The calf:adult ratio of 4:100 obtained during the preceeding winter is the same as the yearling: adult ratio obtained from the calving ground groups. Bulls, as usual, comprised only one percent of the total adults. On occasions, a few young bulls mingle with the calving population, however, most of the bulls noted seem to move toward the calving area after the calving is in progress and then accompany the movement out of the area. Cows two years or older comprise the remaining 95 percent of the adult segment of the herd. This is nine percent higher than in 1956 due primarily to the low percentage of yearlings present.

The overall composition of the calving group can be calculated since the percentage of calves and adults is known for the period June 7-14, and the detailed composition counts during that period provide the proportion of yearlings, adult cows, and adult bulls. The herd composition is shown in Table 6. Similar data from 1954, 1955, and 1956 is included for comparison. The most important aspect is the pronounced downward trend of the calf and yearling classes. If the current data is applicable to that portion of the herd which calved south of the highway, there is little doubt that the productivity level of the Steese-Fortymile caribou herd has dropped significantly. Should this trend continue, a noticeable decline in total numbers will become evident in the future. It should be pointed out here that apparently the problem is not one of actual fertility or initial productivity, but rather calf survival. Initial productivity as indicated in Tables 1 and 2 compares favorably to that determined for previous years.

CALF MORTALITY

One possible index to early calf mortality can be obtained by comparing the initial calf:cow ratio with the final calf:cow ratio observed during the Eagle Summit crossing. The initial ratio was

Table 5. Summary of composition counts of caribou crossing Eagle Summit June 10-18, 1957.

DATE	Calf No.	Calf %	Yearling No.	Yearling %	Cows No.	Cows %	Bulls No.	Bulls %	Total Adults	Total Caribou
6/10	35	13	5	3	208	83	2	1	215	250
6/11	35	19	10	5	136	74	3	1	149	184
6/12	196	23	21	2	646	74	5	5	672	868
6/13	32	40	0	0	48	60	0	0	48	80
TOTAL	298	--	36	-	1038	--	10	-	1048	1382

	CALVES		YEARLINGS	
	Per 100 cows	Per 100 adults	Per 100 cows	Per 100 adults
6/10	17	16	3	2
6/11	26	23	7	6
6/12	30	29	3	3
6/13	67	66	0	0

believed to be approximately 70:100 and the final ratio was 38:100 indicating a 46 percent loss of calves from the time the herd left the calving grounds until they crossed the highway. This is almost twice as high a loss as noted in 1956. Because the data upon which the initial calf crop is based is somewhat limited and inconclusive, it is possible that the indicated mortality is too high.

Calf mortality may also be expressed by the number of cows without calves which have distended udders showing they have produced calves but lost them. Four out of 20 (20 percent) cows without calves had distended udders. By applying this figure to the final calf:cow ratio, it is possible to determine what proportion of cows without calves had produced calves but lost them. Thirty-eight cows per 100 had calves, therefore, 62 cows had no calves; however, 20 percent of these or 12 had produced calves but lost them. The original calf:cow ratio, therefore, must have been 50:100, thus, the calf mortality was 24 percent.

Both methods have merit; however, to attain the desired degree of reliability, considerably more comprehensive coverage is necessary. Composition counts must be extensive enough to be representative of the entire calving group to establish an accurate initial calf:cow ratio. Sample counts of cows with distended udders without calves must be representative of the entire herd, since counts from the first groups crossing the highway during the first days of the migration undoubtedly vary from those taken from the last groups to cross. Daily composition counts have shown that the calf:cow ratio increases from day to day and the number of cows without calves is greatest at the head of the migration. The actual calf mortality probably lies somewhere between the two figures presented. It is apparent that a significant loss occurred during the first two or three weeks of life.

Table 6. Percent composition of caribou herds calving in the White Mountains 1954 through 1957. (Based on composition counts made as they crossed Eagle Summit from the calving area.)

	PERCENT COMPOSITION BY YEAR			
CLASS	1954	1955	1956	1957
Calves	37	30	32	26
Yearlings	11	7	11	3
Cows	51	63	59	70
Bulls	1	T	T	1
Calf:cow ratio	73:100	55:100	54:100	38:100
Yearling:cow ratio	21:100	12:100	16:100	4:100

Causes of mortality have been covered in previous reports on calving in considerable detail. Unfavorable weather, weakness, and inability of calves to keep up with the moving groups, injury of calves due to trampling and falls, lost calves, and predation are the more obvious factors contributing to early calf mortality.

The weather during the entire calving period was mild and, despite fog and cloudiness May 29 to June 2, it did not get cold enough to snow and therefore should not have caused excessive mortality. The weather from June 4 to June 19 was generally good. No snow storms or prolonged rainy spells occurred and the temperature ranged from freezing to the high 50's. Post-calving losses due to weather should have been minimal.

Predation took its toll. A wolf was observed to kill a calf on one occasion and, on another, a grizzly caught what appeared to be a calf out of a herd of 500 caribou but distance prevented positive identity of the victim. A different wolf was seen on another day and a grizzly was observed harrassing a group of 200 caribou for nearly an hour without apparent success. Golden eagles were sighted circling over herds of caribou on 11 different occasions.

Two abandoned calves were found in the wake of herds which had crossed the road. Both were injured and unable to keep up with the herd. One of the calves, a three-day old female, was subsequently taken to Fairbanks for age, growth, and feeding studies.

Calf Survival to Yearling Age: The survival of calves to the yearling stage has been very poor both in 1956 and 1957. As pointed out earlier, the proportion of yearlings accompanying cows to the calving grounds was significantly decreased in 1957 as compared to previous years (Table 5). The ratios for this period are not representative of the herd as a whole, since bulls are not represented in their true proportions at this time of the year. It is merely another indication that the survival of the 1956 calf crop to the yearling stage is very low as compared to previous years.

Calf:adult counts made during October in 1956 and 1957, and during January and February of 1957 and 1958, follow the same pattern for each year. The lack of calves is obvious and reflects serious summer losses (Table 7).

The October counts were made during the time the caribou were migrating across the Taylor Highway. Although late in the rutting season, many bulls still were found with the cows. Complete composition counts were not possible, since the animals seen were moving rapidly. The counts during the winter months were made on bands comprised principally of cows and yearlings plus a few bulls. The latter counts were conducted on scattered bands of caribou ranging from the White Mountains to the Ladue-Sixtymile River country in the Yukon Territory. In addition, caribou were counted east of the Yukon River in the vicinity of the Chandindu River below Dawson.

Table 7. Summary of calf counts 1956-58--Steese Fortymile caribou herd.

SUMMARY OF CALF:ADULT COUNTS
1956-57

AGE IN MONTHS 1956-57	CALVES	ADULTS	TOTAL	CALVES % OF TOTAL	CALVES PER 100 ADULTS
5 Mo. (Oct. 1956)	34	703	737	5%	5:100
8-9 Mo. (Jan.-Feb. 1957)	70	2089	2159	3%	3:100
12 Mo. (June 1957)	36	1048	1084	3%	3:100
1957-58					
5 Mo. (Oct. 1957)	26	550	576	5%	5:100
8-9 Mo. (Jan.-Feb. 1958)	14	430	444	3%	3:100
12 Mo.	Data for this period will be obtained during 1958 calving studies.				

The data tends to be weak in two respects. Primarily, the sample is small and, secondly, it is not positively known whether or not the counts are representative of the herd as a whole. During the winter months, the herd was so widely scattered that it was impossible to tally large numbers of animals. The counts were conducted over a large area and different segments of the herd as a whole. It is entirely possible that the main groups could have been omitted. The yearling:cow ratio at calving time, nevertheless, tends to support the calf ratios of the preceeding fall and winter.

In the Nelchina, calf:adult ratios averaged 20 percent of the total in early April 1956. In the Arctic, during March 1957, calves equaled 23 percent of the total animals counts. Even casual observations are sufficient to see that proportion of calves in these areas are considerably higher than those recorded for the Steese-Fortymile herd.

RECOMMENDATIONS

Data should be collected annually to evaluate the current level of productivity for the Steese-Fortymile caribou herd.

Prepared by:

SIGURD T. OLSON
Wildlife Management Biologist

Approved by:

ROBERT F. SCOTT
Supervisor, Game Restoration

Date: May 14, 1958

JOB NO. 4(a)--Herd Composition Surveys--Nelchina Herd

PERIOD COVERED: May 1, 1957, to April 30, 1958

ABSTRACT

Composition counts taken throughout the year provided information on calf survival and on composition changes occurring with major movements. The effect of hunting was discussed, and kill data from previous years were presented. The herd was estimated on May 1, 1958, to consist of 19 percent yearlings, 46 percent cows, and 35 percent bulls.

OBJECTIVES

To determine sex and age ratios in order to ascertain calf survival and herd composition as an index to the current population status of the herd.

TECHNIQUES USED

Aerial and ground segregation counts taken periodically from the main portions of the Nelchina herd provided information on calf survival through the year and on composition changes occurring with major movements. All counts attempted to classify the animals as completely as possible. Segregation from the air, however, was limited largely to calves, adult bulls, and "others", but from the ground frequently all animals but young calves were sexed and usually the younger bulls could be separated to age-classes. A special effort for ground counts was planned during the rut in early October, because that is the only time both sexes and all age-classes are represented fully.

Both sex and age data were obtained from hunters' kills, the ages being determined by examining the wear on the cheek teeth of lower jaws. All FWS personnel cooperated in gathering this information.

All of the raw data are filed in the Anchorage office of the Federal Aid to Wildlife Restoration Branch.

FINDINGS

The sex and age data gathered during the past year did not indicate any evident change in the herd structure, although the total data

on hand remains rather meager. Inaccessibility of the major portion of the herd during the rut continued to hamper the gathering of significant figures. The main results of the information obtained concerned calf survival and seasonal fluctuations in group segregation.

Sex and Age Data Obtained.

Herd composition data were obtained during every season of the past year. Necessarily, aerial counts supplied most of the figures, because ground contact with major concentrations of the herd proved difficult due to their inaccessibility throughout much of the year. Hunter checking stations and cooperating FWS personnel furnished data on the hunter harvest. The results of the various tallies are presented chronologically in the discussion below.

Spring: Spring movements of the Nelchina herd proceeded as expected, and the composition of the calving groups compared closely with that observed in previous years. During this period most of the bulls tend to remain in or near the wintering areas, although many yearlings, some two-year-olds, and a few adults do accompany the cows to the calving grounds. The segregation that occurs at that time seems typical of most of the caribou herds studied thus far.

Throughout May, ground composition counts were taken at various sections of the calving grounds. Table 1 shows the results of these counts--all reflect the segregation mentioned above.

Ron Skoog and Bob Burkholder made the first count May 7-10, just previous to the start of calving, tallying caribou filing southeastward from a point just south of Clarence Lake. They were able to identify the yearlings of both sexes, to classify the bulls by age-classes, and to sex all the adults and most of the yearlings. Of 2,152 animals tallied, 336 (15.6 percent) were yearlings, 1,710 (79.5 percent) were cows, and 106 (4.9 percent) were bulls. Of 220 yearlings sexed, 102 (46.4 percent) were males, or 86 males:100 females; the lack of males illustrates the tendency of some to remain with the older bulls near the wintering areas. Of the 106 bulls classified by age, 100 (94.3 percent) were two-year-olds, 4 (3.8 percent) were three-year-olds, and 2 (1.9 percent) were four-to-six-year-olds; this classification was based on antler development--two-year-olds having hard antlers yet, no antlers, or velveted knobs; three-year-olds having up to 10 inches of new growth; and the older bulls, more than 10 inches. Of interest in this count was the fact that 21 (21 percent) of the 100 two-year-old bulls still retained hard antlers. Up

to that time the writer had believed that all animals but yearlings and pregnant cows would have shed their hard antlers by May 1. This new knowledge indicates further that some of the two-year-old, non-pregnant cows undoubtedly keep their antlers into May, also.

Three other counts were made by Skoog and Willy Miller during the calving period. These revealed that some of both the yearlings and the bulls had further dissociated from the main calving groups. Table 1 shows the changes occurring in composition.

Meanwhile, from May 16 to June 8, daily calf:adult counts were being made by Burkholder and Jim Whisenhant in the main calving areas. The purpose of these was to trace the rise, peak, and fall of calving activity as indicated by daily calf-increments (see Productivity report). In early June a count in the area just south of Clarence Lake revealed a calf:adult ratio of about 66 percent--604 calves:912 adults (yearlings and older). This figure can be compared directly with the ground composition counts taken May 27-31 in that area (see Table 1). Thus, in early June, the composition of these caribou, including calves, would be in the following ratios:

	Calves		Adults		Yearlings		Cows		Bulls	
Total Animals	No.	%	No.	%	No.	%	No.	%	No.	%
166	66	40	100	60	12	7	86	52	2	1

These figures indicate a calf:cow ratio of about 77 percent for that area in early June.

Summer: After calving, the caribou moved southward to the area lying at the heads of Caribou Creek and the Little Nelchina, Oshetna, and Little Oshetna Rivers, where many bulls joined the ranks. From mid-July to mid-August a major portion of these animals moved northward across the Susitna River. Many passed near the mouths of Watana and Jay Creeks, and there a River Basins crew under Dick Hensel was able to take some composition counts.

Of 717 animals classified, 246 (34.3 percent) were calves, 378 (52.7 percent) were cows, and 93 (13.0 percent) were bulls. The calf:cow ratio of 65 percent either indicates a substantial calf mortality since June or reflects a changed composition of the cow segment. The latter probably is true, because the non-calving cows commonly present on the peripheries of the main calving areas rejoin the groups during the post-calving movements. The bull figure shows that many males had joined the bands by August.

Table 1. Ground composition counts taken during the calving period in May, 1957.

Dates Taken	Total Animals	Yearlings					Cows		Bulls	
		No.	%	♂	♀	♂/100♀	No.	%	No.	%
May 7-10	2,152	336	15.6	--	--	--	1,710	79.5	106	4.9
		--	--	102	118	86				
May 21-23	100	8	8.0	--	--	--	90	90.0	2	2.0
		--	--	3	3	100				
May 24-26	275	30	10.9	15	15	100	242	88.0	3	1.1
May 27-31	748	90	12.0	34	56	61	647	86.5	11	1.5
Totals	3,275	464	14.2	--	--	--	2,689	82.1	122	3.7
		--	--	154	192	80				

Bulls Classified by Age--May 7-10

Total	2 Years Old				3 Years Old		4-6 Years Old	
	Total		w/Antlers					
	No.	%	No.	%	No.	%	No.	%
106	100	94.3	21	21.0	4	3.8	2	1.9

Fall: Throughout the hunting season the main concentrations of caribou remained inaccessible to most hunters. Those segments most exposed were the small bands ranging the periphery areas, and these animals consisted largely of bulls, plus cows mostly without calves. More than half the kill had taken place by mid-September, and much of the sex and age data shown in Table 2 corresponds to that period. The information was gathered by hunter checking stations and by FWS field personnel; the age data were derived from the examination of cheek teeth in lower jaws taken from the kills (see Sampling of Kill report).

The high percentage (75.0) of males composing the kill reflects both caribou availability and hunters' selectivity. Most hunters seem to prefer a bull, or at least they tend to shoot the largest animal in any group they see. The latter factor probably distorts the age ratio of bulls in the kill, also, because naturally the largest bulls are the older animals.

Winter: Aerial composition counts were taken by Burkholder and Skoog in early winter during the last week of October. At that time the main concentration of caribou lay in the Fog Lakes-Deadman Lake region. A separate group of 1,000-2,000 had settled west of Eureka. All the groups tallied still contained many bulls as a result of the rut in early October, but the old males had begun to separate, some having shed their antlers already. In this count the animals were classed as calves or adults; in the adult segment, bulls over four years old were tallied also--these being identified readily by their large antlers or lack of antlers. Table 3 shows the results of the tally.

Most of the bulls probably still were represented fully in the groups tallied, although a few of the old ones had left. Last year's ground composition counts during the rut, though limited, revealed that about 43 percent of the adult animals were bulls. That figure applied to the data in Table 3 would result in the following segregation of the animals tallied:

Total Animals	Calves	Cows	Bulls
2,919	596	1,324	999

Thus, the calf:cow ratio in late October approximated 45 percent--realizing, of course, that the calculation possibly was based on incomplete data. That used, however, were the most accurate available.

Table 2. Sex and age composition of 1957 caribou kill, as obtained from examination of hunters' kills.

Sex	Denali		Palmer		Field Checks		Total	
	No.	%	No.	%	No.	%	No.	%
Male	374	74	358	72	112	91	844	75
Female	132	26	137	28	12	9	281	25
Total	506	100	495	100	124	100	1125	100

Age	Male		Female		Unknown		Total	
	No.	%	No.	%	No.	%	No.	%
Calf	4	2	4	6	3	17	11	4
Yearling	13	8	7	10	6	33	26	10
2 Years	36	21	11	16	1	6	48	19
3 Years	40	24	14	20	3	17	57	22
4-6 Years	48	28	22	32	4	21	74	29
7-9 Years	25	15	9	13	1	6	35	14
10 + Years	3	2	2	3	0	0	5	2
Total	169	100	69	100	18	100	256	100

Table 3. Aerial composition counts taken October 23-29, 1957.

Area	Total Animals	Calves		Adults				Calf Ratios		
					Cows &	Bulls				
		No.	%	Total	Bulls	No.	*%	Calf/Total Animals	Calf/ Adults	Calf/Adults minus Bulls
Deadman Lake	1,371	264	19.3	1,107	891	216	*19.5	19.3	23.8	29.6
Fog Lakes	1,144	240	21.0	904	826	78	* 8.6	21.0	26.5	29.1
Eureka	404	92	22.8	312	299	13	* 4.1	22.8	29.5	30.8
Total	2,919	596	20.4	2,323	2,016	307	*13.2	20.4	25.7	29.6

*Percent of total adults.

Another series of aerial counts were taken in late winter during mid-April by Skoog and Abe Thayer. Again most of the caribou were in the Fog Lakes-Deadman Lake region. By then calving groups had started to drift toward the calving grounds, and adult bulls were noticeably few. The animals were classed as calves or adults, the latter as being with or without hard antlers. By that date only the calves (short yearlings), some yearlings (short two-year-olds) and a few two-year-olds (short three-year-olds) of both sexes, and pregnant cows still retain hard antlers. Several small bands of calves were noted, indicating that some already had left their mothers. Table 4 shows the results of these counts. Most counts were taken in the Kosina-Fog Creek area, and these were considered most valid. Counts along Watana Creek and on the Lake Louise flats revealed a much higher percentage of bulls, those identified being without antlers. Some of the yearling (short two-year-old) bulls do still carry antlers at this time (see Table 1), and these animals closely resemble cows; also, some cows have lost their antlers. The high calf:adult ratio (38.8) obtained in the Kosina-Fog Creeks area, however, indicated that few bulls of any age were present. There the groups consisted mostly of the calving segment, probably quite similar in composition to that from which the May 7-10 counts of 1957 were taken (see Table 1). The adult caribou in the latter segment were composed of 94 percent cows. This figure was applied to the April 16-19 counts of 1958 to obtain the following composition for the caribou in the Kosina-Fog Creeks area:

		Adults				
			Cows		Bulls	
Total Animals	Calves	Total	No.	%	No.	%
1,872	523	1,349	1,268	94	81	6

Thus the estimated calf:cow ratio in mid-April, 1958, after almost one year, was slightly over 41 percent.

Discussion: The data presented thus far illustrate the changing composition that occurs within the main portions of the herd throughout the year. In spring the main segment is composed mostly of cows, calves, and yearling, with but a smattering of bulls; many male yearlings and non-calving cows, plus the adult bulls, remain on the peripheries of the calving groups, frequently still on the wintering grounds. During the summer most of the latter animals rejoin the calving groups, although many of the adult bulls do not, especially

Table 4. Aerial composition counts taken April 16-19, 1958.

Data	Lake Louise Flats	Watana Creek	Kosina-Fog Creeks
Counts:			
Total Animals Tallied	103	332	1,872
Calves	27	60	523
Adults: Total	76	272	1,349
w/Antlers	65	224	1,271
w/o Antlers	11	48	78
Ratios: (Percent)			
Calf/Total Animal	26.2	18.1	27.9
Calf/Total Adults	35.5	22.1	38.8
Calf/Adults w/Antlers	41.5	26.8	41.1

the old ones. By late September and early October (the rut), however, both sexes and all age classes are represented fully in the main concentrations of animals. In late October the adult bulls start to separate again, and by December many remain by themselves, alone or in small groups, although they seem to take part in some of the major winter movements. The following spring results in the dissociation of the calving groups once again.

In the whole area, however, the composition of the caribou bands can vary greatly, and hence counts from various portions of the herd usually do not compare. The greatest variable seems to be the percentage of adult bulls present, although non-pregnant cows and cows without calves frequently are not distributed uniformly, nor are the yearlings at certain times. The most consistent segment of the herd seems to be that containing the cows with calves; other animals join or leave this segment variously during the year for unknown reasons. Thus an attempt is made to relate all counts to the calf-cow segment--except those obtained during the rut.

A discussion of the foregoing composition counts as concerns calf mortality during the past year appears in the report on productivity--Job No. 3(a). That concerning the sex and age structure of the herd follows.

Herd Composition.

Significant data concerning the population structure of a caribou herd are difficult to obtain. Perhaps the greatest difficulty results from the extensive movements and changing composition of the entire herd. Accurate sex ratios can be obtained during the rut, providing the main concentrations are accessible from the ground. Age-ratio data, however, depend mostly on the hunters' kill, which seldom is unbiased. A number of factors influence both ratios.

Influencing Factors: The initial birth-rate probably is the most basic factor affecting the sex ratio. Numerous studies in the past regarding a number of different mammals have indicated that for many species frequently more males than females are born. After birth, a differential mortality adversely affecting the males tend to make the ratio approach 1:1 and finally to favor the females. Limited data available from the Nelchina herd tend to support this view, although actually too few to be significant. Table 5 shows the sex ratios of fetuses, calves, and yearlings, as obtained from field counts, calf tagging, and

Table 5. Sex ratios of fetuses, calves, and yearlings, as obtained from field counts, calf tagging, and hunters' kills.

Sex	Age Category			Total
	Fetus	Calf	Yearling	
Total	22	60	477	599
Male	15	37	241	293
Female	7	23	236	266
Males/100 Females	214	161	102	110

hunters' kills. It is assumed that very little bias exists in obtaining sex data from these three age-categories. Table 5 shows that the ratio drops from 214 males/100 females in the fetus age-category, to 161 in the calf, and to 102 in the yearling. No interpretation of these figures will be attempted until a larger sample of fetuses and calves can be examined. The implication, however, is evident.

Differential mortality exerts an effect on both the sex and age ratios. Although the causes of such possible mortality in the age-categories mentioned above are unknown, that affecting animals older than yearlings can be attributed directly to hunters' selectivity. Table 6 summarizes the kill data since 1952. During the six years shown an estimated 13,150 caribou were taken, of which about 72 percent were males. Such a continual disproportionate take certainly lowers the relative number of adult males in the herd.

The bias toward males results mainly from the hunters' tendency to select the largest animals from a band, or those with the largest antlers. This tendency also influences the age structure of the kill; most cows seem to reach maximum growth at two years old, but bulls continue to grow in body and antler size until they reach the age of seven or more. Thus hunters are apt to take a random age-sample of the adult cows, but to take a disproportionate number of the older bulls. Calves and, to a certain extent, yearlings of both sexes seldom are represented fully in the kill. Table 7 shows the age-structure of the hunters' kill in 1955, 1956, and 1957, as determined from the examination of lower jaws collected during the hunting season. Actually, the male and female segments are of similar magnitude in the various age-classes. The selectivity for older males, as explained above, however, would tend to pad the older age-classes of bulls, and hence these classes should contain lower percentages.

Present Status: The data available are not sufficient to determine exactly the sex and age structure of the herd. Limited composition counts made in October, 1956, together with data presented in Tables 4 and 5, remain the principal basis for classifying the herd at the present time.

The 1956 counts indicated a bull:cow ratio of 76:100 among the adults (see PR report, W3R11); the yearling:cow ratio approached 41:100 on May 1 of this year (see Table 4); and the sex ratio of these yearlings approximated 102 males:100 females (see Table 5). Therefore, on May 1, 1958, the composition of the Nelchina herd was estimated as follows:

Table 6. Sex ratio of hunters' kill in Nelchina caribou herd, 1952-1957.

	*1952	*1953	1954	1955	1956	1957	Total
Total Kill Estimate	450	700	2,000	4,000	3,500	2,500	13,150
Males: No.	419	588	1,440	2,880	2,240	1,875	9,442
Percent	93	84	72	72	64	75	72
Females: No.	31	112	560	1,120	1,260	625	3,708
Percent	7	16	28	28	36	25	28

*Bulls-only season

Table 7. Age structure of hunters' kill in Nelchina caribou herd, 1955-57.

	Calf		Yearling		2 Yrs.		3 Yrs.		4-6 Yrs.		7-9 Yrs.		10 + Yrs.		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	Total
1955:															
Male	2	1	22	15	27	19	31	21	45	31	14	10	4	3	145
Female	1	2	8	19	4	10	6	14	19	45	4	10	0	0	42
Total	3	2	30	16	31	16	37	20	64	34	18	10	4	2	187
1956:															
Male	17	6	46	17	53	20	44	16	53	20	51	19	7	2	271
Female	4	3	23	15	26	17	39	25	42	27	14	9	6	4	154
Total	21	5	69	16	79	19	83	20	95	22	65	15	13	3	425
1957:															
Male	4	2	13	8	36	21	40	24	48	28	25	15	3	2	169
Female	4	6	7	10	11	16	14	20	22	32	9	13	2	3	69
Total	8	3	20	9	47	20	54	23	70	29	34	14	5	2	238
Total:															
Male	23	4	81	14	116	20	115	20	146	25	90	15	14	2	585
Female	9	3	38	15	41	16	59	22	83	31	27	10	8	3	265
Total	32	4	119	14	157	18	174	20	229	27	117	14	22	3	850

Adult Cows	Adult Bulls	Yearlings ♂	Yearlings ♀	Yearlings No.	Total
100	76	21	20	41	217

These figures are proportionate and can be expressed in percentages as follows: cows, 46; bulls, 35; and yearlings, 19. No attempt was made to break down the animals into age-classes because of the insufficient data presently on hand.

RECOMMENDATIONS

A concerted effort should be made to obtain composition counts during the rut.

Information on the age-structure of herd is inadequate also, and needs to be supplemented by much more data.

Periodic calf counts are necessary to trace calf mortality throughout the year.

Prepared by:

Ronald O. Skoog
Wildlife Management Biologist

Approved by:

Robert F. Scott
Supervisor of Game Restoration

Date: April 30, 1958

JOB NO. 4(b): Herd Composition Surveys--Steese-Fortymile Herd

PERIOD COVERED: May 1, 1957 to April 30, 1958

ABSTRACT

Herd composition data collected during 1957-58 provided information on the present status of the Steese-Fortymile caribou herd.

1. The sex ratio of the kill was 144♂:100♀. The unbalanced sex ratio is thought to be the result of hunter preference for males.

2. Calf counts indicate that only 3 1/2 percent of the total herd were calves indicating very low calf survival for the second year.

3. Age composition for the adult segment of the herd (based on analysis of jaws from hunter kills) shows a continued trend toward larger, older age classes (4-6 years) and smaller, younger age classes (2-3 years). This indicates either herd stabilization or decrease in number and general thriftiness of the herd.

OBJECTIVES

To determine sex and age ratios in order to ascertain calf survival and herd composition as an index to the current population status of the herd.

TECHNIQUES USED

Sex and age data were obtained at the checking station on the Taylor Highway October 1-14, 1957. All hunters' kills checked through the station were sexed and a sample (28 percent of the kill) of 90 lower jaws were collected from caribou two years or older to determine the age structure of the adult portion of the herd. Calves and yearlings were aged by field inspection of the jaws, none of which were collected. Herd composition data pertinent to these two classes were obtained from calf and yearling counts conducted in June during the migration from the calving grounds, in October during the migration across the Taylor Highway, and in January and February on the winter ranges.

FINDINGS

Sex ratios: The adult sex ratio obtained from 321 kills checked through the Fairplay checking station was 144♂:100♀. Insufficient calves and yearlings were taken to determine sex ratios for these

classes. As in past years, the sex ratio reflects the hunters' preference for bulls. The sight of a large set of antlers is quite irresistible. No other sex ratio data were obtained during the year. There is no reason to deviate from the present assumption that the adult sex ratio is approximately 100♂:100♀.

Age ratios: A summary of the age data obtained from the Fortymile caribou kill is presented in Table 1. The lack of calves and yearlings is immediately obvious for they comprised only three precent of the total kill as compared to 27 percent for the Nelchina area in 1956. The calf and yearling kill has never been high in the past three years, however, this segment of kill for the past two years has been less than four percent. There are two contributing factors. One is hunter selectivity; the other is the low percentage of animals in these two age groups. Calf counts obtained during the winter of 1956-57 (see Table 7, Job 3(b)), indicated that calves made up only 3 1/2 percent of the total animals. Therefore, a weak yearling age class would be expected in the 1957 kill. Calf counts obtained during the fall and winter months of 1957 and 1958 revealed calf ratios similar to those obtained in 1956-57, again, indicating poor calf survival (Table 7, Job 3(b)). Although hunters seldom take calves, the extremely small proportion of calves in the herd is also reflected in the take.

In past years the age composition of the bulls taken has varied from the females. The differences have been thought to be the result of hunter preference for the larger antlered bulls, particularly those of the 4-6 year class which generally have the best antler growth. The age structure of the female segment of the kill has, therefore, been used as an index for the herd as a whole since female antler development is so varied that hunters do not readily shoot them selectively. The 1957 age data, however, showed only slight variations in these age classes between males and females. It may be coincidence or the result of a growing preference on the hunters' part to avoid taking larger bulls which might be "strong" due to the rut. The greatest variation occurred in the 7 1/2 - 9 1/2 year class. The larger proportion of bulls in this class is probably due to hunter selectivity.

For the sake of uniformity, the age structure for the female segment of the herd will continue to be regarded as the best index to age composition for the herd as a whole. Since calves and yearlings are not adequately represented in the hunter kills, comparisons with similar data are limited to adult caribou two years or older.

Table 1. Age distribution of 324 caribou taken by hunters on the Taylor Highway - October 1-14, 1957

AGE CLASS	MALES No.	%	FEMALES No.	%	TOTAL No.	%
5-6 Mo.(1)	0	0	2	2	2	1
1 1/2 Yrs.(1)	6	3	1	1	7	2
2 1/2 Yrs.(2)	14	7	8	6	22	7
3 1/2 Yrs.	28	15	23	17	51	16
4 1/2 - 6 1/2 Yrs.	111	58	84	63	195	60
7 1/2 - 9 1/2 Yrs.	32	17	15	11	47	14
TOTAL	191	100	133	100	324	100

(1) Age percentages for calves and yearlings obtained from field examination of kills checked through the station.

(2) Age percentages for adults 2 years or older obtained from sample of 40 male jaws and 50 female jaws collected at Fairplay checking station.

The gradual trend toward older age classes continues to be very evident as shown in Table 2. Age composition for both males and females is presented to show that the trend is evident for both of the sexes despite bias introduced by hunter selectivity in case of the males. The gradual weakening is very pronounced in the 2-3 year classes from 1954 to 1957 and the strengthing of the 4-6 year is likewise pronounced. The 7-9 year classes are not as uniform when males and females are regarded separately. However, the combined figures indicate a slight increase. In the 10+ year class, too few of either sex have been taken to be significant. This may be the result of heavier wolf predation due to theincrease of wolves in this area during the past two years.

Assuming no significant gain or loss to the herd through emmigration or immigration, the continuing trend toward larger older age classes indicates either stabilization or possibly even deterioration within the Steese-Fortymile caribou herd. The low calf

Table 2. Comparison of age distribution of hunters kills - Steese-Fortymile caribou 1954-57. (All kills during September and October).

	1954		1955		1956		1957	
FEMALES	No.	%	No.	%	No.	%	No.	%
2-3	39	54	116	46	57	31	12	24
4-6	21	29	86	35	91	50	32	64
7-9	10	14	45	18	28	16	6	12
10+	2	3	3	1	5	3	0	0
TOTAL	72	100	250	100	181	100	40	100
MALES								
2-3	44	70	147	53	30	28	9	23
4-6	13	21	104	37	60	55	24	60
7-9	5	8	27	10	18	17	7	17
10+	1	1	0	0	0	0	0	0
TOTAL	63	100	278	100	108	100	50	100
TOTALS								
2-3	83	62	263	50	87	30	21	23
4-6	34	25	190	36	151	52	56	62
7-9	15	11	72	14	46	16	13	15
10+	3	2	3	T	5	2	0	0
TOTAL	135	100	528	100	289	100	90	100

survival rate for the past two seasons should make itself evident during the coming hunting seasons in 1958 and 1959. Present data, thus, indicate a probable reduction in total numbers for the entire herd since the present 2-3 year age class is already weak.

Theoretical age composition: A theoretical age composition of the herd as of early winter 1957 can be calculated roughly using known ratios and percentages on a herd of 1000 animals. Calf:adult counts indicate that four percent or 40 individuals are calves leaving a balance of 960. Yearling counts in June 1957 substantiated by calf counts the preceding winter show that yearlings comprised about four percent of the total. Little change should be expected by fall, thus, an additional 40 individuals are yearlings leaving 920 caribou older than two years. By using the percentages obtained in the analysis of female jaws from hunters kills (Table 2), the age distribution for the remainder of the herd is as follows:

Age	2-3	221 individuals
	4-6	599 individuals
	7-9	110 individuals

Expressing the numbers obtained above as percents of 1000, the age composition of the herd is: Calves, 4 percent; yearlings, 4 percent; 2-3 years, 22 percent; 4-6 years, 60 percent; and 7-9, 11 percent. Although the data are limited and weak in several respects, it is another indication the Steese-Fortymile caribou herd is not thriving. The lack of individuals in the younger age classes represents a lack of adequate reproduction. This can only lead to a downward trend in the population in the future.

RECOMMENDATIONS

Sex and age data should continue to be collected annually to evaluate the current population status of the Steese-Fortymile caribou herd.

Prepared by:

SIGURD T. OLSON
Wildlife Management Biologist

Approved by:

ROBERT F. SCOTT
Supervisor, Game Restoration

Date: May 14, 1958

JOB NO. 5: Caribou Stomach Analysis

PERIOD COVERED: July 1, 1957 to April 30, 1958

ABSTRACT

Twelve stomach samples were analyzed. A sample from the reticulum of one stomach was analyzed for comparison with the rumen sample of the same stomach.

It is becoming evident that data based on analysis of the large plant particles in the samples are inaccurate and misleading, particularly for lichens which tend to be present in larger proportions than the data indicates.

A method devised to measure the amount of material passing through the separating screens indicated that much of the stomach content is comprised of protozoa (not yet identified).

OBJECTIVES

1. To determine the proportions of various foods present in the caribou stomach at all seasons of the year.

2. To establish a method for rapid analysis of samples taken from caribou stomachs.

3. To establish whether stomach analysis present a true picture of the relative proportions of caribou food intake by species or genera of ingested plants.

TECHNIQUES USED

Tentative methods of approaching the problem of identification of small particles, and, conjunctively, establishing a fast and reliable method of analyzing stomach samples, include:

1. Chemical -- separation of types of plants by chemical coloration, solvents, etc.

2. Mechanical -- separation of types by flotation, centrifugal force, controlled combustion, etc.

3. Microanalytical.

This is a continuation of the work accomplished under the previous project segment W-3-R-11 at the Alaska Cooperative Wildlife Research Unit, University of Alaska (see quarterly report of the Alaska Cooperative Wildlife Research Unit, Vol. 8, No. 4 for detailed description of procedures and findings for work accomplished under W-3-R-11).

FINDINGS

Work on the project was limited to the final quarter (April-June) of 1958. Detailed analysis of 12 stomach samples were completed during the quarter. In addition to the analysis of rumen contents, a reticulum was analyzed by the same method to determine whether there was any substantial difference between the contents of the two parts of the stomach.

The data from the above work has not yet been analyzed. It is evident that any data based only on an analysis of the larger plant particles in a stomach sample would not only be inaccurate but brossly misleading, particularly as concerns the amount of lichens. The proportions of lichens are almost invariably higher than an investigator would be led to believe from an analysis of the larger plant particles only. The only possible exception to this may be those samples into which the lichens wereintroduced in a moist condition, in which case, the amounts of these plants present in the largest particle size may nearly approximate the true proportion in the stomach. (See quarterly report of the Alaska Cooperative Wildlife Research Unit, Vol. 8, No. 4 for an explanation of "particle size", etc.)

In addition to the methods previously reported, a method was found to measure the amount of material passing through all the separating screens. The results of this measurement were quite startling. They indicated that if a rumen sample is run through a series of screens, the smallest of which has a mesh of 200/inch, less than half of the material in the rumen will be retained by the screens. This appears to indicate that the majority of the contents of the stomach is not vegetable, but animal, since over 90 percent of the material in both that part of the sample retained by a screen of 200 meshes per inch and that which goes through all screens is composed of animalcules (protozoa). The protozoa mentioned above have not yet been identified.

RECOMMENDATION

The data from the detailed stomach analysis should be presented in a completion report. This report should also include an evaluation of the technique as a suitable method for studying caribou food habits.

Prepared by:

ALAN M. COURTRIGHT
Biological Aid

Approved by:

ROBERT F. SCOTT
Supervisor, Game Restoration

Date: April 30, 1958

JOB NO. 7--Winter Range Utilization--Nelchina Herd

PERIOD COVERED: November 1, 1957, to March 31, 1958

ABSTRACT

Two field trips during the winter of 1957-58 provided limited data on the utilization of the range by caribou during that season. Feeding areas were examined along the upper Talkeetna River and in the Fog Lakes region. Eleven caribou were collected for stomach samples.

The main food plants eaten by the caribou in these two areas proved to be lichens and sedges. Some animals also had fed upon the buds and twigs of willow.

The data gathered showed that in a feeding area of moderate use there was one pawed-out plot for approximately every 40 square meters of ground; the total amount actually disturbed by the feeding reached only 0.7 percent of the whole. In a feeding area of heavy use there was one pawed-out plot for approximately every 11 square meters of ground; the total amount disturbed was only 2.2 percent.

About 95 percent of the plots examined completely contained broken or uprooted portions of plants--the lichens being the most damaged. Trailing affects the vegetation adversely, also, but its effect is difficult to evaluate.

The significance of the data gathered will not be known until a more thorough coverage of the range is made and until the range study as a whole is completed.

OBJECTIVES

To determine quantitatively the vegetation types utilized most by caribou during their winter feeding.

To determine the food plants most frequently sought and eaten by caribou during the winter months.

To determine the percentage of ground actually disturbed and the amount of vegetation destroyed by the "pawing" of caribou during their winter feeding.

TECHNIQUES USED

Transects composed of ten-meter-square quadrats spaced twenty meters apart were run across winter feeding areas of caribou. Within these quadrats, the area of each pawed-out plot made by a feeding animal was recorded in square meters, and the plants occurring in each plot were listed by species. Meters were used for measurement to facilitate a direct comparison between these data and that obtained from past range work. Notations were made, when possible, as to which plants were eaten, and broken branches or uprooted plants were noted. In addition, the following general information was recorded for each quadrat: vegetation type, elevation, and snow depth and condition. Also, at each location visited a number of caribou were killed for stomach samples to gain further information on the food plants eaten.

The raw data obtained are filed in the Anchorage office of the Federal Aid to Wildlife Restoration branch.

FINDINGS

This project did not receive the attention needed for conclusive results. The greatest hindrance proved to be the lack of snow during the past winter. A thin snow-cover prevailed over most of the Nelchina caribou range well into November, reaching only about eight inches in depth by October 31 in the Eureka area--an area which normally has one of the deepest snow-covers of any portion of the range. December snows brought the total to about 12 inches on the major wintering grounds, but the limited daylight at that time made extensive field operations impractical. This twelve-inch layer remained unsupplemented through the remaining winter except for light snowfalls that soon melted. Thus, in the wintering areas supporting the largest concentrations of caribou, most of the snow-cover soon became so disrupted that one could not distinguish pawed-out feeding holes from those made by trampling, trailing, or melting; in addition, the wind erased some feeding sign and exposed the ground in many places.

Two field trips provided only limited data, although both served to point out the conditions needed for best results, the equipment required, and the overall problems involved in gathering significant data. The first trip, in mid-February, encompassed a portion of the wintering grounds on the upper Talkeetna River, and the second, in latter March, a section of heavy feeding use in the Fog Lakes region. Each is described in detail below.

Talkeetna River.

In January and February a major portion of the Nelchina caribou herd settled on the upper Talkeetna River. Bands extended along the river from Prairie Creek to the head of the Chickaloon River, along all the major tributaries in that section, and also westward onto Iron Creek. By mid-February caribou tracks, trails, and feeding areas thoroughly covered the whole basin of the upper Talkeetna River. Ron Skoog and Don Richards encamped in that region February 15-20 at a cabin located about three miles upstream from the mouth of Aspen Creek. Snowshoe trips into the surrounding area provided the data gathered on winter range utilization.

The Talkeetna River basin exhibits the typical "U-shaped" cross-section commonly associated with glaciated valleys. Near the mouth of Aspen Creek the river-bed lies at 2,500 feet elevation and ranges from 200 to 500 yards in width, containing several channels and many gravel bars. Both banks are rather steep, having slopes of 10-20 degrees at the base and of 20-30 degrees above timberline--which lies at about the 3,300 foot level on the right bank (east) and the 3,000 foot level on the left. The peaks on each side reach a maximum of slightly under 7,000 feet.

The main vegetation types found there were as follows: 1) Spruce-Dwarf Birch-Heath-Lichen, composing the timbered areas just above the river-bed; 2) Dwarf Birch-Heath-Lichen, forming a narrow band of transition at timberline; and 3) Heath-Lichen, the major type lying above timberline to at least 4,000 feet. Areas above 4,000 feet elevation were not examined. In addition, some of the river bars supported good growths of willow.

Caribou trails were prevalent along the river bed and through the timbered areas, yet few animals had stopped to feed. Some, however, had eaten the dried leaves and the tips of twigs of willow along the river bars, while others had pawed-out plots in the snow amongst the spruce, eating the sparsely scattered lichens occurring there. Most of the feeding took place in the Heath-Lichen vegetation type above timberline between 3,200 and 4,200 feet elevation, mostly on slopes of 15-25 degrees. Only the feeding activity in the latter type was of a magnitude worth sampling by the method described previously, but the thin snow-cover, varying from 4 to 12 inches in depth, was so old and compacted and so disrupted that the field crew could not find a suitable area. They finally settled for one small section of about 3,400 square meters that had not been too disturbed by the caribou, and examined all the pawed-out plots occurring therein. Table 1 shows the frequency of occurrence

Table 1. Frequency of plants occurring in pawed-out plots made by caribou feeding in a Lichen-Heath vegetation type on the upper Talkeetna River--examined February 15, 1958.

Total Pawed-out Plots Examined--86				
	Plots w/Plant		Plots w/Broken-Up-rooted Plants	
Plants	No.	Percent	No.	*Percent
Woody:	86	100.0	37	43.0
Arctostaphylos alpina	11	12.8	0	0.0
Betula glandulosa	11	12.8	1	9.1
Cassiope tetragona	27	31.4	5	18.5
Empetrum nigrum	75	87.2	36	48.0
Ledum decumbens	41	47.7	12	29.3
Salix reticulata	8	9.3	0	0.0
S. sp.	6	7.0	1	16.7
Vaccinium uliginosum	74	86.0	18	24.3
V. vitis-idaea	37	43.0	2	5.4
Lichens:	86	100.0	85	98.8
Cetraria cucullata	42	48.8	40	95.2
Ce. islandica	34	39.5	32	94.1
Cladonia alpestris	32	37.2	32	100.0
Cl. rangiferina	72	83.7	68	94.4
Cl. sylvatica	83	96.5	83	100.0
Dactylina arctica	13	15.1	11	84.6
Sedge: Carex sp.	56	65.1	0	0.0
Moss	72	83.7	19	26.4
Other: Lycopodium sp.	36	41.8	0	0.0

*Of the plots that actually contained the plant.

of the various plants in the 86 plots analyzed. The section examined probably would be classed as one of moderate use.

The table reveals that lichens, heaths, and sedges were the dominant plants in that vegetation type. Of these, it appeared that lichens were the primary food item and sedge (Carex sp.), the secondary. Lichens occurred in all of the plots examined and the most abundant species were Cladonia sylvatica and C. rangiferina, although none was of particularly good growth. The principal heaths were crowberry (Empetrum nigrum), blueberry (Vaccinium uliginosum), labrador tea (Ledum decumbens), and low-bush cranberry (Vaccinium vitis-idaea), none of which seemed to be a food item. All of the plots examined contained broken branches or uprooted portions of plants, the lichens being the ones most frequently damaged by the pawing action.

Stomach samples obtained from seven caribou killed in that area at that time, viewed superficially, contained mostly lichens and sedge, plus a fair amount of dwarf-birch leaves and unknown twigs. These samples will be analyzed in detail at a later date for comparison with the pawed-out plot data.

Fog Lakes.

In early March the caribou began moving northeast from the Talkeetna River toward the Fog Lakes across a pass located just east of Stephan Lake. On March 15 over 10,000 animals were moving above timberline across the hills lying about ten miles south of Fog Lakes. The movement progressed steadily, but the animals fed heavily in certain areas, and one of these areas proved readily accessible from a small lake nearby. Skoog and Jack Lentfer camped beside this lake March 21-26 and ran sampling transects in the major vegetation type utilized by the caribou.

This region, bounded by the Talkeetna River, Stephan Lake, Fog Lakes, and Tsisi Creek, consists of moderately rugged mountains lying at approximately 3,000 to 6,500 feet elevation. Numerous gentle slopes and small plateau-like mountains are interspersed with steep, rocky ridges. The vegetation is alpine and, in the area examined, consisted of three major types: 1) Willow-Sedge, prevalent in the valleys of the major streams; 2) Sedge Meadow, common on the poorly drained land of gentle slopes above the valleys; and 3) Sedge-Heath, frequently adjacent to the previous type, but in areas of better drainage. The steep slopes seemed to support mostly a Heath-Lichen vegetation,

although the field crew did not check enough for complete verification. At that time the snow-cover ranged from 10 to 15 inches, but many moss hummocks and steep, south-facing slopes were exposed. The caribou had not been in the area long enough to disrupt the feeding areas too much.

The Sedge-Willow type had been utilized to some degree by the animals, but not to any great extent. Sedge and the buds and twigs of willow seemed to be the main food items. The second type, Sedge Meadow, although not extensive in that area, had received a fair amount of use--sedge, of course, being the major plant eaten. Lichens were very scarce in both of these types.

The Sedge-Heath type, however, appeared to be the favored source of food throughout the area examined. Feeding sign there indicated heavy use during the previous three weeks. A portion of this type was sampled by two transects, each 1,500 meters long and consisting of 50 ten-meter-square quadrats, spaced and analyzed as described under TECHNIQUES USED. To save time, however, the crew recorded the plant species occurring in the pawed-out plots of only the first five quadrats of each transect; the apparent uniform distribution of the plant species in this type seemed to justify this action. Only measurements were taken of the plots (857) in the other 90 quadrats. Table 2 shows the frequency of occurrence of the various plants in the 57 plots examined completely.

As evident from the data presented, the dominant plants in the Sedge-Heath type were sedge (Carex spp.), lichens (mostly Cladonia sylvatica and C. rangiferina), and heath (Empetrum nigrum, Vaccinium vitis-idaea, and Arctostaphylos alpina). All of the lichens, however, although appearing in most of the plots, were of poor growth and of scattered distribution. Sedge proved to be the primary food plant in this type, also; lichens were of secondary importance. Over 90 percent of the 914 plots examined contained plants with broken or uprooted portions.

Visual inspection of stomach samples taken from four caribou killed in the area at that time tended to verify the above statements regarding the main plants eaten. These samples will be analyzed in detail later.

Discussion.

These field trips provided information from only two portions of the Nelchina caribou's wintering grounds. Many other sections of the

Table 2. Frequency of plants occurring in pawed-out plots made by caribou feeding in a Sedge-Heath vegetation type in the Fog Lakes region--examined March 22-24, 1958.

Total Pawed-Out Plots Examined--57				
	Plots w/Plant		Plots w/Broken-Up-rooted Plants	
Plants	No.	Percent	No.	*Percent
Woody:	57	100.0	47	82.5
Arctostaphylos alpina	23	40.4	0	0.0
Cassiope tetragona	15	26.3	6	40.0
Diapensia lapponica	3	5.3	2	66.7
Dryas sp.	2	3.5	0	0.0
Empetrum nigrum	49	86.0	41	83.7
Ledum decumbens	1	1.8	0	0.0
Loiseleuria procumbens	4	7.0	1	25.0
Salix reticulata	7	12.3	0	0.0
S. sp.	7	12.3	0	0.0
Vaccinium uliginosum	11	19.3	3	27.3
V. vitis-idaea	37	64.9	6	16.2
Lichens:	53	93.0	43	81.1
Cetraria islandica	22	38.6	14	63.6
Ce. nivalis	4	7.0	2	50.0
Ce. richardsonii	5	8.8	1	20.0
Cladonia alpestris	15	26.3	9	60.0
Cl. rangiferina	29	50.9	24	82.8
Cl. sylvatica	46	80.7	34	73.9
Cl. spp.	11	19.3	4	36.4
Dactylina arctica	19	33.3	11	57.9
Sedge: Carex spp.	51	89.5	3	5.9
Grass	12	21.1	4	33.3
Moss	48	84.2	22	45.8
Other: Lycopodium sp.	4	7.0	0	0.0

*Of the plots that actually contained the plant.

winter range need to be examined before definite conclusions can be reached as to the vegetation types favored. The data do, however, point out once again that sedge is an important winter food, possibly sharing equal importance with lichens. The main contribution of last winter's work, however, concerns the actual areal utilization of the range by caribou during their feeding. Table 3 summarizes the data obtained regarding this aspect of the project.

The feeding area examined on the Talkeetna River was classed as one of moderate use. Within a section of 3,400 square meters were 86 pawed-out feeding plots, averaging 0.29 square meters each--one plot for approximately every 40 square meters. The area actually disturbed by the pawing totaled only 25.14 square meters, or 0.7 percent of the whole section.

The feeding area examined in the Fog Lakes region was classed as one of heavy use. Within the sampled portion of 10,000 square meters were 914 pawed-out plots, averaging 0.24 square meters--one plot for approximately every 11 square meters. The total area actually disturbed by the pawing totaled only 218.85 square meters, or 2.2 percent of the sampled portion.

These data serve to illustrate the limited area of the range affected by the feeding of caribou, even under heavy use. Their cursory feeding habits probably tend to preclude the possibility of the utilization percentage ever exceeding 10 in any one section of the range, even if the herd were to concentrate there for several weeks. The latter statement is pure conjecture, however, because generally the animals disperse over a wide area during the winter. Within the pawed-out plots themselves, however, much of the vegetation is destroyed or damaged. Of the 138 plots examined completely, about 95 percent contained uprooted or broken portions of plants. The lichens seemed to be the ones affected most, and they, unfortunately, are the plants probably least capable of withstanding damage.

Other factors of caribou behavior besides feeding may affect the vegetation adversely, and trailing, perhaps, is one of the most important. The single-files of moving animals frequently cut trails to the mineral earth; old trails, bare of vegetation, are common throughout the range. These form footholds for the erosion factors and the damage can become even more extensive. Yet, even though a trail may not penetrate the snow-cover, perhaps the compaction of the vegetation causes damage. The actual effect of trailing is difficult to evaluate, but quantitative measurements probably should be made in connection with the overall range work.

Table 3. Summarized data of range utilization by feeding caribou, as determined by the examination of two feeding areas during the winter of 1957-58.

Items Tabulated		Talkeetna River	Fog Lakes
Dates Examined		February 15, 1958	Mar. 22-24,'58
Snow-Cover		4" - 12", Old	10" - 15", Old
Slope		15-20 Degrees	3-5 Degrees
Vegetation Type		Lichen-Heath	Sedge-Heath
Total Quadrats		0	100
Total Feeding Area Examined		3,400 square m.	10,000 sq. m.
Total Pawed-Out Plots		86	914
Plot Density: One plot for every		40 sq. m.	11 sq. m.
Average No. of Plots/Quadrat		--	9
Area of Plots:	Total	25.14 sq. m.	218.85 sq. m.
	Ave. Plot	0.29 sq. m.	0.24 sq. m.
Percent of Total Area Utilized		0.7	2.2
Total Pawed-Out Plots Checked for Plants		86	57
Plots w/Broken-Uprooted Plants:			
	No.	86	52
	Percent	100.0	91.2

A number of problems came to the fore during this range study last winter, and descriptions of these appear below:

It was difficult to determine which plants had been eaten from the pawed-out plots. The great amount of plant segments broken by the pawing action usually obscured what little evidence of feeding that existed--especially with lichens. Sedges and grasses were the only food plants not affected much by the pawing, and eaten portions of these frequently could be detected. The forage plants will have to be determined largely from stomach samples.

Identifying plants in the winter always proves somewhat of a problem. The important identification features of many of the plants are missing, especially from the grasses and sedges. It is hoped that proper identification can be made by revisiting each winter feeding area during the following summer.

The sampling technique used takes a great deal of time. Each pawed-out plot requires at least a minute to analyze completely, and each quadrat, depending on the number of plots, about ten minutes. Thus, a fifty-quadrat transect takes about eight hours for two people to run. In addition, the collection of five to ten caribou for stomach samples may take several days in areas of low density. The short winter days and the time-consuming chores of winter camping extend the time element further.

All in all, the project will require a great deal of time and effort for the amount of data gathered. Yet no alternative exists. It is hoped that the more extensive field work planned for next winter will provide a more complete picture.

RECOMMENDATIONS

More extensive field work is needed to provide significant data regarding winter range utilization by caribou.

Prepared by:

Ronald O. Skoog
Wildlife Management Biologist

Approved by:

Robert F. Scott
Supervisor of Game Restoration

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